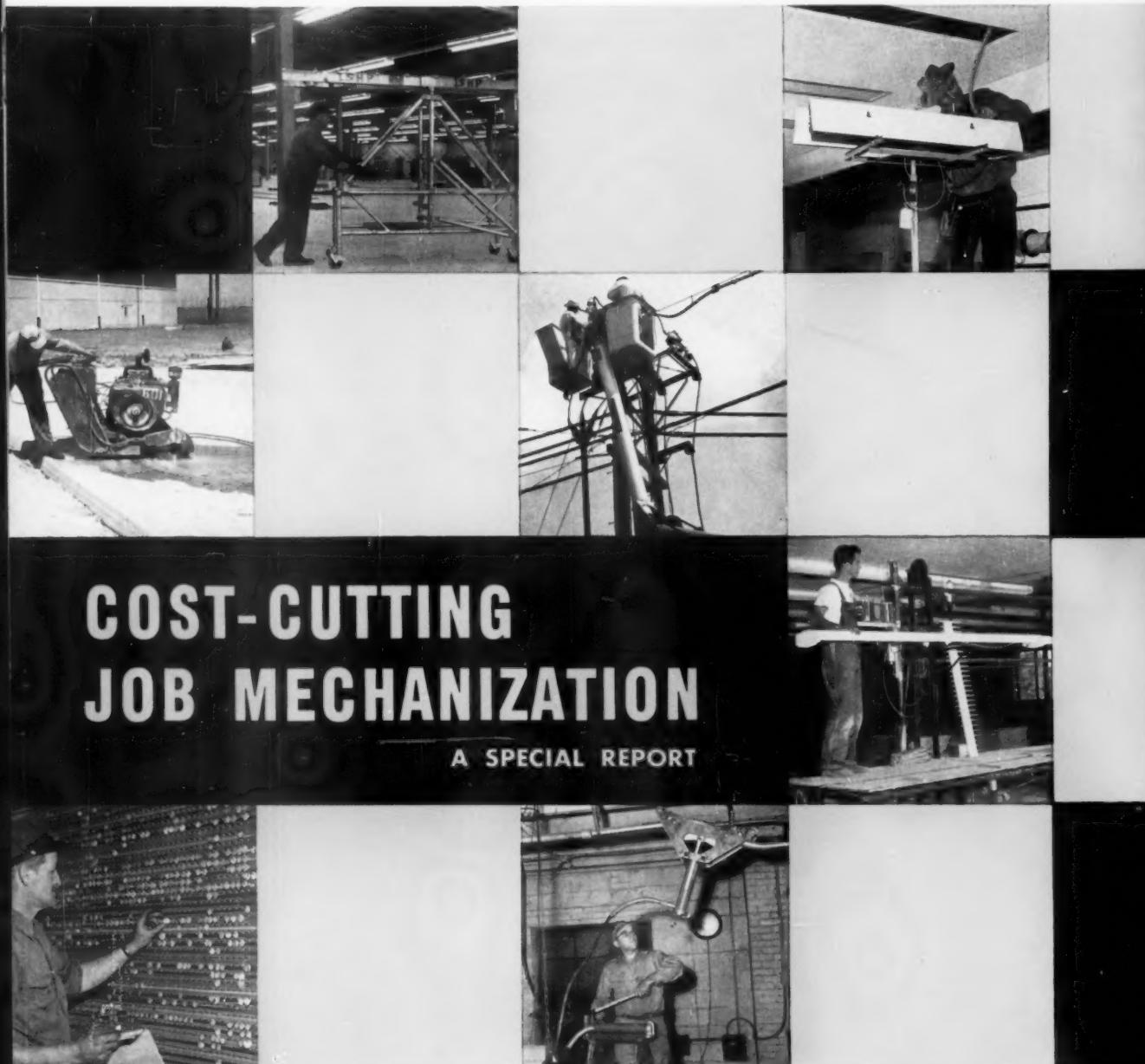


JULY
1959

PRICE 75 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



COST-CUTTING JOB MECHANIZATION

A SPECIAL REPORT

A McGRAW-HILL PUBLICATION 58TH YEAR

PHONE: JEFFERSON 3-3200
CABLE ADDRESS BRASCOLITE



only Guth makes Grateelite louver diffuser*

*U.S. PAT. NO. 2,748,001
CAN. PAT. 536,245

June 1, 1959

We take great pride in announcing the new

NON-COMBUSTIBLE
"NC GRATEELITE"
LOUVER DIFFUSER

In the past four years, over \$100,000.00 has been spent on the development of this grand, new lighting tool. There have been hours, months, even years—of tedious testing, expensive experimental molds, heart-breaks and "what-have-yous". We've been through the wringer on this baby—but now we have a great new product to offer!

For the first time, a fire resistant, molded plastic louver is now available to our lighting trade. This louver has been listed by Underwriters' Laboratories, Inc. with a low 25-rating. This places "NC Grateelite" in the non-combustible grouping.

"NC Grateelite" will be cataloged in the immediate future. Deliveries can be made after July 1st.

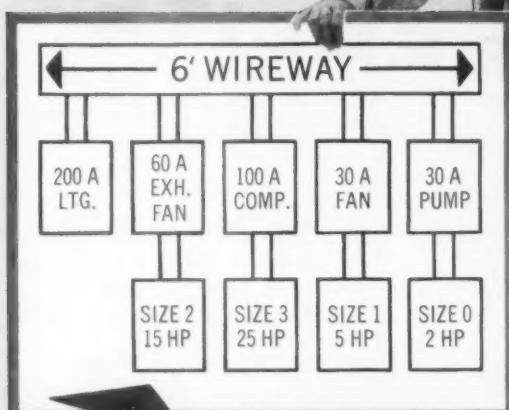
E. F. Guth, Jr.
President

*® T.M., U.S. and Can. Pats.

Trusted Name in Lighting since 1902

STARTERS IN QMB PANELBOARDS!

ANOTHER SQUARED FIRST!



IT TAKES
41 HOURS AND 6 FEET
OF WALL SPACE TO INSTALL
AND WIRE SWITCHES
AND STARTERS LIKE THIS

IT TAKES
12 HOURS AND 30 INCHES
OF WALL SPACE FOR THE
SAME INSTALLATION WITH A
QMB STARTER PANELBOARD

Why mount separate starters and disconnect switches? It costs extra money. It wastes space. It takes a lot more time. QMB Starter Panelboards give you a *safer* installation because you can't open a starter when the switch is ON. They give you a much *better looking* job. Since they can even be *flush* mounted, they offer a lot more installation *flexibility*. QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 3. QMB switchboards and unit substations handle sizes 0 through 5. All of them are available, factory-assembled and wired. Or get enclosures, starters and plug-in switch units from your Square D distributor for on-the-job assembly.



Notice how the plug-in switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

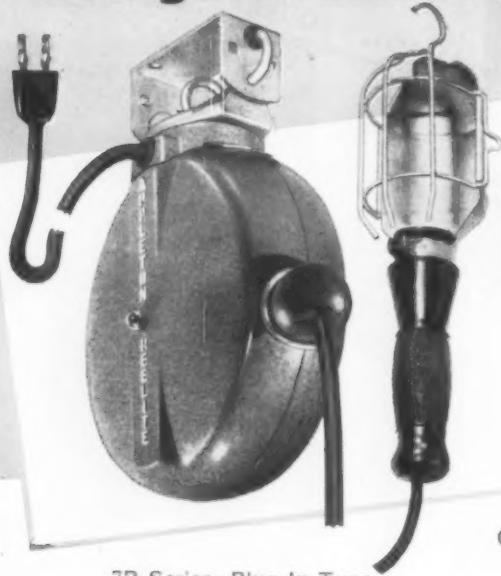
It's easy to order these starter and switch units. See Page 57 in your Square D Digest and order from your distributor.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE



SQUARE D COMPANY

You get **MORE** when you choose an...



APPLETON® portable REELITE®

**Greater Selection...
Lower Cost with Finest Quality**

7P Series—Plug In Type

Unlimited mounting flexibility is built into this Reelite. Universal type mounting bracket for wall use. Hook eye for ceiling use. Plugs into receptacle. Positive stop action. Equipped with handlamp, guard, switch and half reflector.

7S Series—Outlet Box Mounting

A finest quality Reelite with continuous 360° swivel action. Uninterrupted power with double silver alloy collector brushes. Handlamp must be ordered extra. Special vaporproof model is equipped with vaporproof handlamp.

1500 Series—Outlet Box Mounting

Hanger plate fits neatly over any 4" octagonal outlet box. Up to 50 feet cord length depending on model. Handlamp must be ordered extra. *Special light spring tension models for use by garment manufacturers. These models will not support weight of handlamp.

Write for Descriptive Bulletin

Gives complete details on all models of APPLETION portable Reelites... with accessories illustrated. Write for Free Bulletin PRT 259



APPLETON Reelites
help prevent employee
injuries due to extension
cord entanglements.

No matter what the need, you'll find there's an APPLETION Reelite to do the job... a reel so sturdily built, so well engineered it's a bargain at the price.

Eliminate the hazards of tangled, twisted cords and assure yourself of durable equipment that gives years of service... by installing APPLETION portable Reelites.

All APPLETION portable Reelite models are equipped with regular 2 or 3 conductor SJO cord. Where 3-conductor cord is used, the Reelite is grounded since the extra conductor is connected directly to the Reelite frame.

Handy Order Information

CATALOG NO.	CORD LENGTH	CORD TYPE	CATALOG NO.	CORD LENGTH	CORD TYPE
RE-7P2	25 Ft.	18-2 SJO	RE-1519G	40 Ft.	18-3 SJO
RE-7P2G	25 Ft.	18-3 SJO	RE-1520	50 Ft.	18-2 SJO
RE-7S2	25 Ft.	16-2 SJO	RE-1520G	50 Ft.	18-3 SJO
RE-7S2G	25 Ft.	18-3 SJO	RE-1521	25 Ft.	18-2
RE-7SV2	20 Ft.	18-3 SJO	RE-1521G	25 Ft.	18-3
RE-1511	50 Ft.	18-2	RE-1532	12 Ft.	16-2 SJO
RE-1519	40 Ft.	16-2 SJO	RE-1532G	12 Ft.	18-3 SJO

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Malleable Iron
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Hand Lamp



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and MAINTENANCE**

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electrogist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

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Sidelights

COST-CUTTING TOOLS & METHODS

In these times of rising wage rates and chronic shortage of skilled manpower the role of tools and methods in electrical construction, installation and maintenance takes on ever increasing importance. To meet the pace of electrical progress, management must be constantly in search of new ways to expand the effectiveness of its labor force; which, because of the long training required cannot, in numbers alone, be built rapidly enough to meet the needs of the market for their services.

By far the largest potential opportunity for expanding the effectiveness of our work force lies in three basic and mutually compatible directions: job mechanization, improved means of job access, and the use of methods and materials which reduce the work load.

Job mechanization has come a long way in a relatively few years. Power driven machines, power tools, and specialized tools of high mechanical advantage are rapidly taking the place of time-consuming and muscle-wearing hand methods. And as electrical contractors apply these tools in larger numbers, the manufacturers are stimulated to develop increasingly ingenious and valuable improvements. One of the most fruitful areas for further exploration is the mechanical handling and positioning of heavy materials. Fork lift trucks, special hoist riggings and specially designed jacks have to be used by many contractors to take a good share of the muscle-work out of heavy conduit and busway installations.

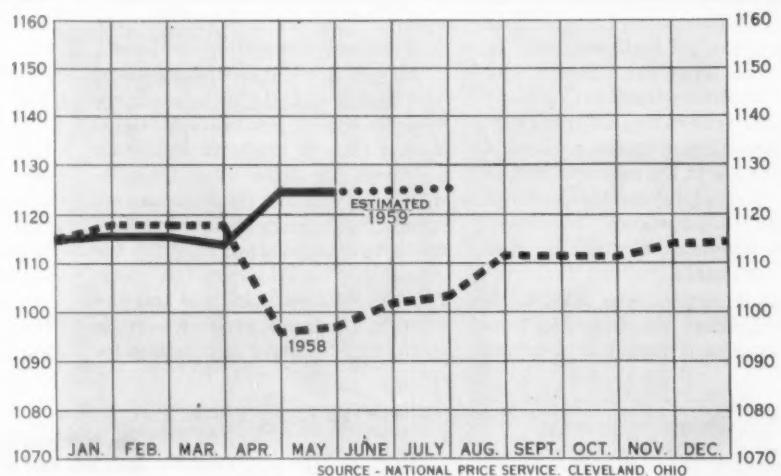
Job access has been greatly improved by the use of specialized scaffold assemblies which give mechanics a large, safe platform to work from. Even newer hydraulic lifts and booms are rapidly coming into the picture. They can place men at relatively great heights in complete security without even the chore of climbing.

Methods and materials that cut the work load cover a very broad range. They may be a small lug indenter, a rapid fastening device, an ingenious busway coupling, or a light-weight conduit fitting. Manufacturers are constantly seeking new design features to cut installation time and complexity to give their products the advantage of a lower installed cost. To gain these advantages requires close coordination between the estimator and the material buyer. The lowest installed cost is not always produced by materials with the lowest invoice cost.

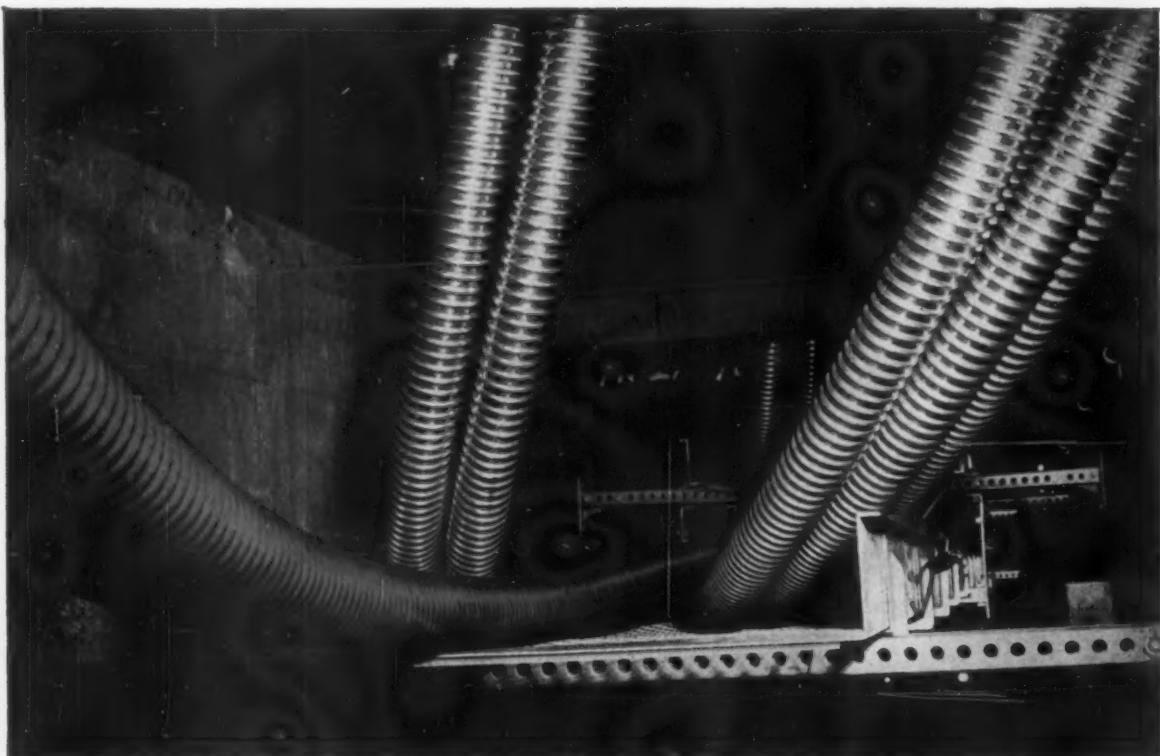
Many electrical contractors today, on approaching the end of their fiscal year, are carefully appraising new tools and equipment as a potentially advantageous area to absorb depreciation reserves and to plow back earnings. To them and to everyone interested in improving job management, we commend the special editorial report by Associate Editor August Eckel, which occupies the entire feature section of this issue. It is a comprehensive and up-to-date round-up of practical cost-cutting tools and methods used by electrical contractors and industrial electrical departments. It begins on page 75.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



Quick identification for high voltage primaries is provided by an Okonite-developed, baked-on enamel finish in bright orange. In this access tunnel below transformer enclosure 3/c 15kv Okonex primaries are laid in same tray with 3/c 600v Okonex secondaries with plain aluminum Loxarmor. Plant and electrical system were engineered and designed by Southwestern Engineering Company. Electrical contractors were Trowbridge & Flynn Electric Company.

"Power supply is vital," said Diamond Gardner Corp. "We furnished Okonite cables," said Del E. Webb and SWECO

Here was an ultra-modern, completely integrated manufacturing operation where power failures could trigger a costly "chain reaction" in down time. That's one reason why Del E. Webb Construction Company and Southwestern Engineering Company furnished Okonite cables for extensive use in the new and unique mechanical pulping mill for Diamond Gardner Corporation's Integrated Forest Products Center at Red Bluff, California.

Another reason was SWECO's knowledge that The Okonite Company, because it alone makes cables

by all methods, is uniquely qualified to help select the best cable for a specific circuit . . . and manufacture it to suit any installation conditions.

All primary and secondary power and control circuits in the plant are Okonite cables. For example: lightweight Okonex-insulated Loxarmor primaries, identified by an Okonite-developed bright orange, baked-on enamel finish, carry all power at 12kv to the twin transformer vaults in the plant. 600-volt Watertite-Loxarmor, 600-volt Okonex-Loxarmor and 5kv Okonex-Loxarmor, in racks, were selected for secondary distribution for

their flexibility, low installation costs and the ease with which circuits can be added or re-routed. 600-volt Okotherm control cables were specified for circuits where high heat conditions are encountered.

Okonite quality . . . Okonite's ability to build cables by any method . . . and Okonite's expert design and installation assistance are factors to consider when ordering or specifying cables for your important installations. For more data on Loxarmor, write for free, 36-page Bulletin EC-1090, The Okonite Company, Passaic, New Jersey.



where there's electrical power . . . there's

OKONITE CABLE

6214



**EASIER TO DO...
and costs less too!**

B-M
INDENTER
FITTINGS and TOOLS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding lock-nuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



BM-51
1/2" Offset Connector



Red Throat
BM-21B
1/2" Connector



Red Throat
BM-22B
3/4" Connector



Red Throat
BM-23B
1" Connector



BM-41
1/2" Coupling



BM-42
3/4" Coupling



BM-43
1" Coupling



BM-21
1/2" Connector



BM-22
3/4" Connector



BM-23
1" Connector



BM-No. 600
Changeable
Jaw Indenter



BM-No. 1000
Handvise for 1/2",
3/4" and 1" E.M.T.



BM-No. 100
Cutter for 1/2",
3/4" and 1" E.M.T.



BM-No. 607
1/2" Indenter
BM-No. 608
3/4" Indenter



All B-M indenter type fittings for exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL
METHOD
TOOL
CO.
GALVA • ILLINOIS

Washington Report

JULY • 1959

The business outlook is fine as statistics on business guideposts and the national economy continue to set new highs month after month. Dept. of Commerce officials predict new highs for business activity in the 3rd quarter as the business advance showed a better-than-seasonal pace and on a broadening scale as the 2nd quarter came to a close. And National Association of Purchasing Agents expect the second half of this year to be better than the first half, based on its survey of business conditions in May.

Here are some of the statistics contributing to optimism and to the spread of a "boomy" feeling:

- **Industrial production** hit a new high in May—152 on the FRB Index, or 6 points above the 1956 peak.
- **Personal income** reached a new high of \$376 billion in May, bolstered by climbing factory payrolls.
- **Employment** climbed to a new May record of 66 million workers, with a strong rise in manufacturing employment, while **unemployment** dropped 240,000 in May to 3.4 million, or 4.9% of the work force—lowest since November 1957.
- **Capital spending** is again on the rise, with a total outlay of \$32.57 billion predicted for 1959 as compared with \$30.53 billion last year.
- **Gross national product** (GNP) was estimated at annual rate of \$477 billion in June, is expected to hit annual rate of \$500 billion by year's end.

Inflation continues as a major threat to national economy growth and to a "sound dollar," in the opinion of Eisenhower Administration officials, as they strive to balance the Federal budget and to hold down Federal spending on money bills voted by a Democratic-run Congress dedicated to higher spending. This subject will receive growing consideration in the months ahead, as studies of the causes of inflation are completed and reported on.

Foreign competition for U. S. markets is another problem of growing concern. Pleas for protection are flowing into Washington for import limits and higher tariffs. Further, American manufacturers are finding it ever more difficult to compete for foreign markets. The problem is reportedly the high cost of production of American-made products due to high labor rates (as compared with those of foreign producers) and increasing costs of raw materials. Watch for growing discussion of this subject by the Administration, and in Congress.

American manufacturers of electrical equipment are a case in point. Foreign producers are underselling American producers in the American market. The Office of Civil and Defense Mobilization recently rejected a request of General Electric Co. and National Electrical Manufacturers Association for a ban on imports of heavy electrical equipment on the premise that such imports were harming national security. OCDM disagreed, after study of the problem for several months.

Housing demand looks solid as the monthly rate of starts indicates about 1.3 million homes will be built this year. This would be the third-largest housing year in history, trailing only 1950 and 1955.

New construction activity in May expanded seasonally to \$4.6 billion, bringing the total for the first five months of 1959 to \$19.7 billion, or 13% ahead of same period last year.

You name it - NuTone has it

12 BASIC NUTONE EXHAUST FANS* FOR YOUR KITCHENS & BATHROOMS



Model 851-N for Ceiling or Wall. Snap-In motor and fan assembly. \$36.95 list.



Model 831-N. Powerful 8-inch fan for use in Ceiling or Inside Wall. \$27.95 list.



Model 870 Twin Blower. for installation in cabinet, wall, ceiling. \$39.50 list.



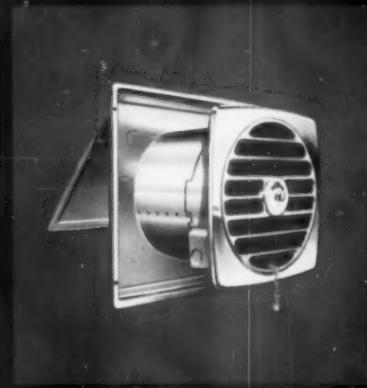
Model 820-NJF. Jet-Flo Fan for Vertical Discharge through roof cap. \$22.95 list.



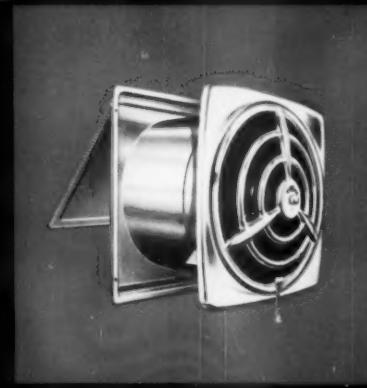
Model 848. Powerful Vertical Discharge 10" fan. Snap-in Fan assembly. \$29.75



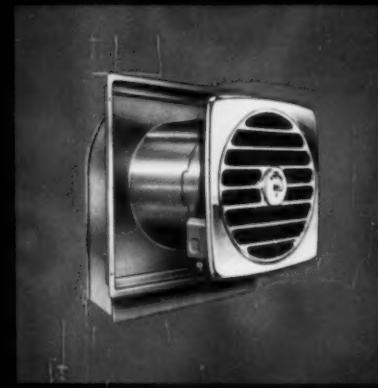
Model 881 Bathroom Fan. A blower type fan with a high static pull. \$25.95 list.



Model 801. 8" Pull chain type for Wall with weather-tight shutter. \$27.95 list.



Model 811 Deluxe 10" pull chain Wall Fan. Weather-tight shutter. \$36.25 list.



Model 807 Automatic Wall Fan. Patented flutter-proof shutter. \$27.95 list.

* Illustrated here are 9 of 12 basic models

America's most complete line of Exhaust Fan

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NuTone Quality Costs You No More!

FEATURES LIKE THESE MAKE NUTONE YOUR BEST BUY!



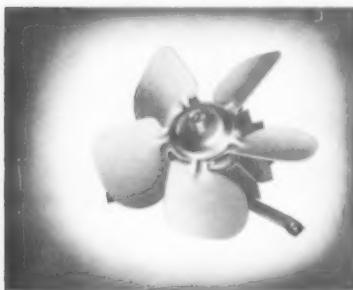
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Installation

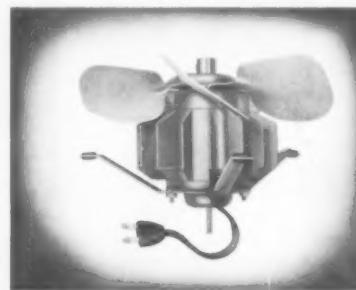
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FOR Better
Performance

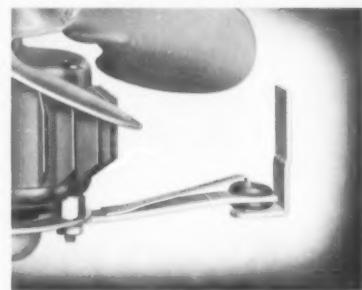
MODEL #851-N (FOR CEILING OR WALL) IS A TYPICAL EXAMPLE OF THE
MANY OUTSTANDING FEATURES FOUND IN EVERY NUTONE EXHAUST FAN



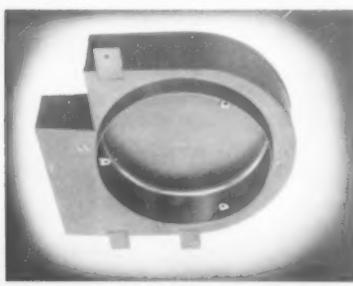
Specially designed fan blades . . . plus a powerful 1/20 HP motor for higher air delivery.



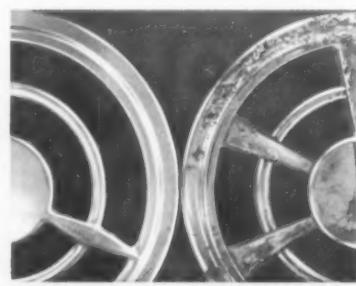
Closed motor prevents grease from clogging windings. Extended fins keep motor cool.



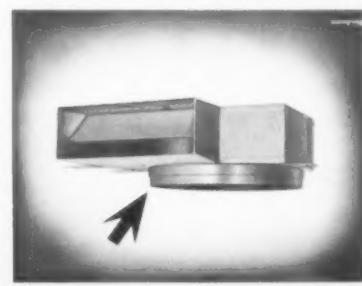
Automatic safety grounding strap. Approved by UL & CSA. Avoids shock and fire hazards.



Venturi Housing . . . prevents air back-lashing. This produces higher "Static Pressure Push".



NuTone Anodized Grille (left) will not corrode like the ordinary chrome grille (on right).



Adjustable sleeve insert . . . for different plaster thickness . . . hides rough cutouts.

SEE OTHER SIDE

FREE..DELUXE CATALOGS IN BINDER..Write NUTONE, INC., Dept. EC-7, Cincinnati 27, Ohio

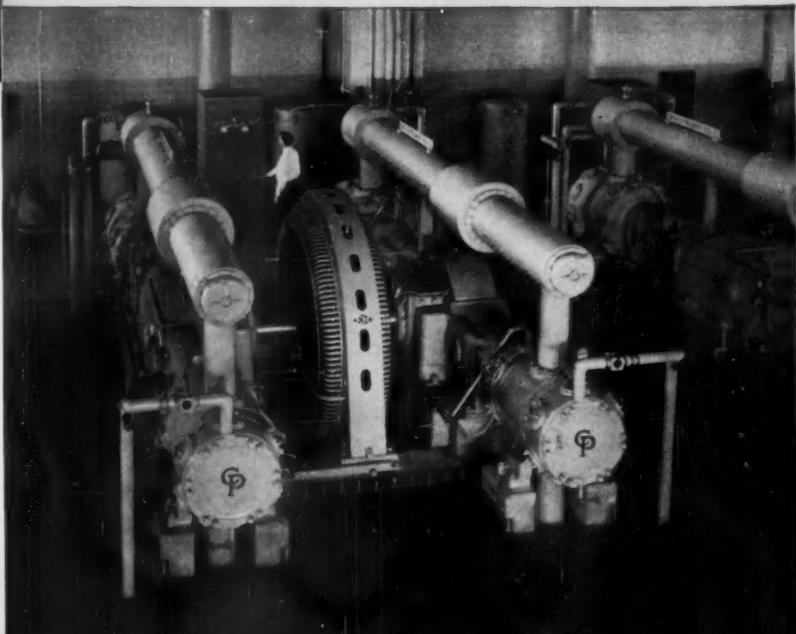
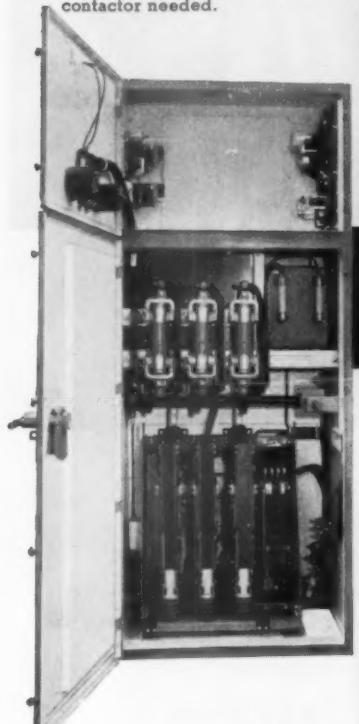
SMART BUILDERS CHOOSE NUTONE BUILT-IN HOOD-FANS•EXHAUST FANS
DOOR CHIMES•CEILING HEATERS•INTERCOM-RADIO•BUILT-IN FOOD CENTER



The most complete synchronous motor protection you can buy

Above and at right • Four EC&M 1000 HP, 2300 Volt Synchronous Starters on air-compressor drives in Chrysler Corporation's new Ohio Stamping Plant at Twinsburg. Purchased and installed by Hatfield Electric Co., Cleveland, Ohio.

Below • Inside view of starter showing compact arrangement of fuses and contactor. The three arc shields slide out for quick access to both front and rear contacts—no draw-out of contactor needed.



EC&M 2200-4800 VOLT STARTERS

• A push of the "start" button gives you complete protection during starting and running—plus EC&M fully automatic synchronization. Throughout the entire sequence, motor windings are completely protected and synchronization occurs at the most favorable time. Should the motor pull out of step because of voltage dip or overload, the field is automatically removed. Re-synchronization occurs when the motor re-accelerates the load. Short circuit protection is provided by current-limiting power fuses working in conjunction with EC&M's "certified" high-interrupting-capacity ZHA air-break contactor.

For complete details...

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THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

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HOW

CBM

ASSURES YOU BETTER BALLAST VALUE

*ETL checks 12 to 14 specified ballast characteristics
on all Certified types in production
by each manufacturer, verifies compliance
by test . . . and does it every month!*



THIS is important: Because if any ballast fails to measure up, the right to carry the emblem "Certified CBM by ETL" is withdrawn.

What characteristics are checked? The operating qualities which the American Standards Association has determined will give dependable, rated performance from the lamps with which the ballasts are designed to be used. These constitute the CBM Specification and assure:

High power factor • High light output • Positive starting • Rated lamp life • Limit on heat rise • Control for steady light • Quiet operation

From these qualities come practical benefits: Up to 2,500 hours more lamp life than with ordinary ballasts; as much as 40% more light output; and savings

on installation . . . with less wire, fewer circuits needed for fixtures CBM equipped . . . fewer fixtures for the same level of light.

For the latest facts on why it pays to specify fixtures equipped with Certified CBM Ballasts, ask us to send you CBM NEWS.



**CERTIFIED
BALLAST
MANUFACTURERS**

2118 KEITH BUILDING
CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify

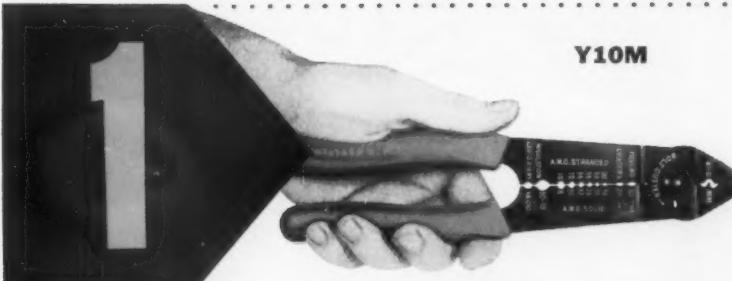
2-59

GET THE BIG 3

IN COMPRESSION-CONNECTOR TOOLING

1

Y10M



Light-weight hand tool installs a wide variety of HYDENT® connectors on wire sizes #22 thru #10. A wire cutter and single indentor die for all wire sizes are in the nose of the tool. Other features are wire stripper, bolt cutter, thread chasers, and dies for closing insulation-grips.

2

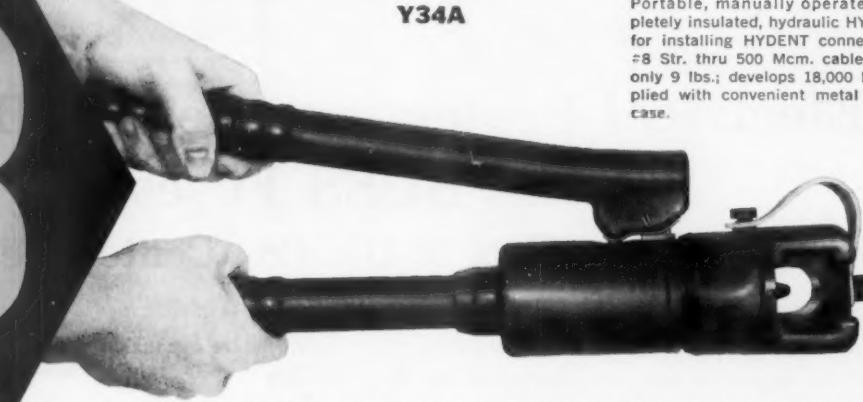
MY29-3



This HYTOOL® features one easily adjusted die set that installs HYDENT on commercial copper cable from #8 to 250 Mcm. and on aluminum conductors #8 to 4/0. Indexing plates are used for setting adjustable nest die for either copper or aluminum. No dies to install, change, identify or lose.

3

Y34A



Portable, manually operated, completely insulated, hydraulic HYPRESS® for installing HYDENT connectors on #8 Str. thru 500 Mcm. cable. Weighs only 9 lbs.; develops 18,000 lbs. Supplied with convenient metal carrying case.

Contractors with an eye on cutting connector installation time count on the Burndy Big 3. This Y10M, MY29-3, Y34A combination crimps practically every type and size compression connector on any job...adds the versatility, speed, and economy that result in profitable jobs. See your local Burndy distributor for demonstration and low prices.

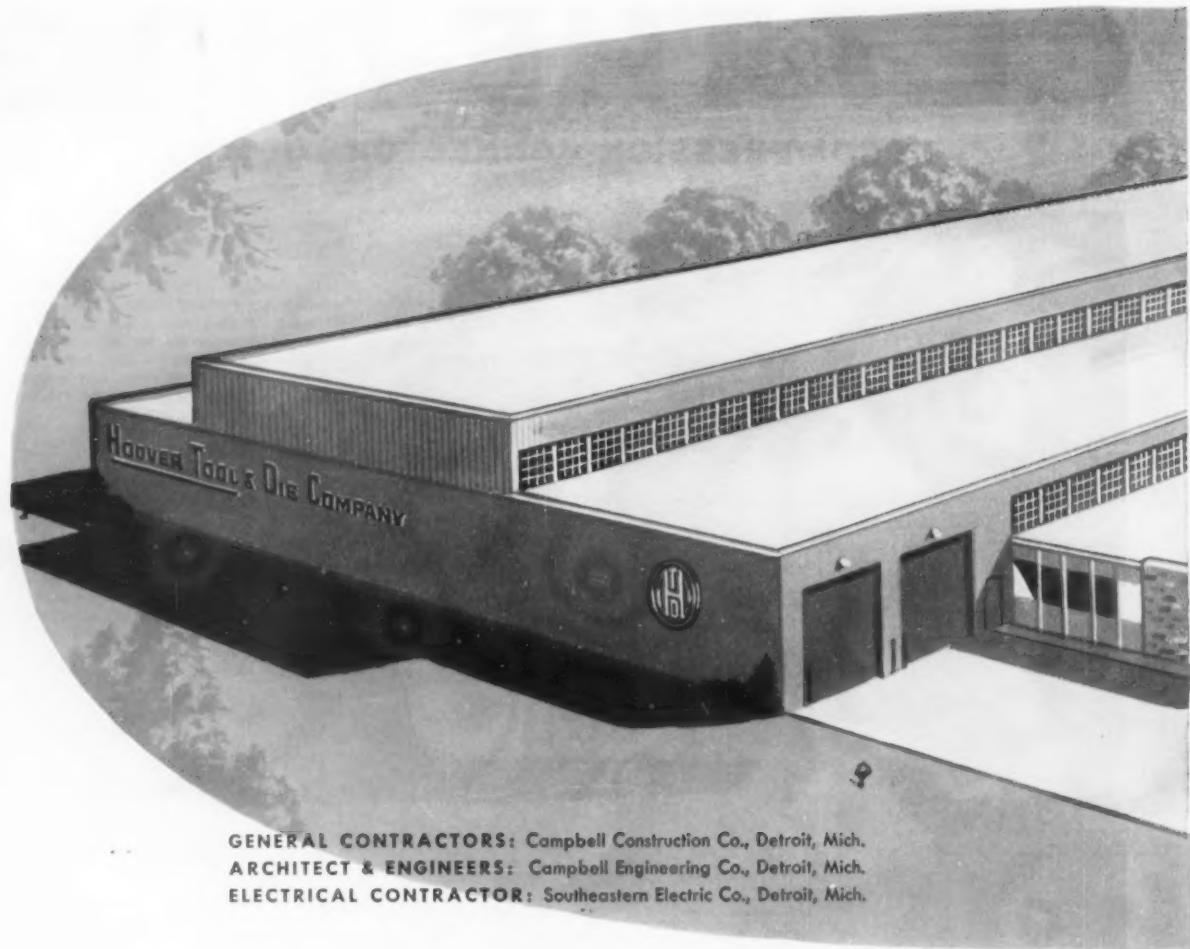
BURNDY

Norwalk, Connect.

In Europe: Antwerp, Belgium

59-15

Toronto, Canada



Electrical Protection goes MODERN with BUSS Fuses in the Hoover Tool & Die Co., Centerline, Mich.

This new industrial plant on the outskirts of Detroit illustrates that the modern trend in electrical protection is to fuses. The main switch gear is a 1600 ampere pressure switch protected by BUSS Hi-Cap fuses. The distribution panels, both power and light, are equipped with FUSE-TRON dual-element fuses.

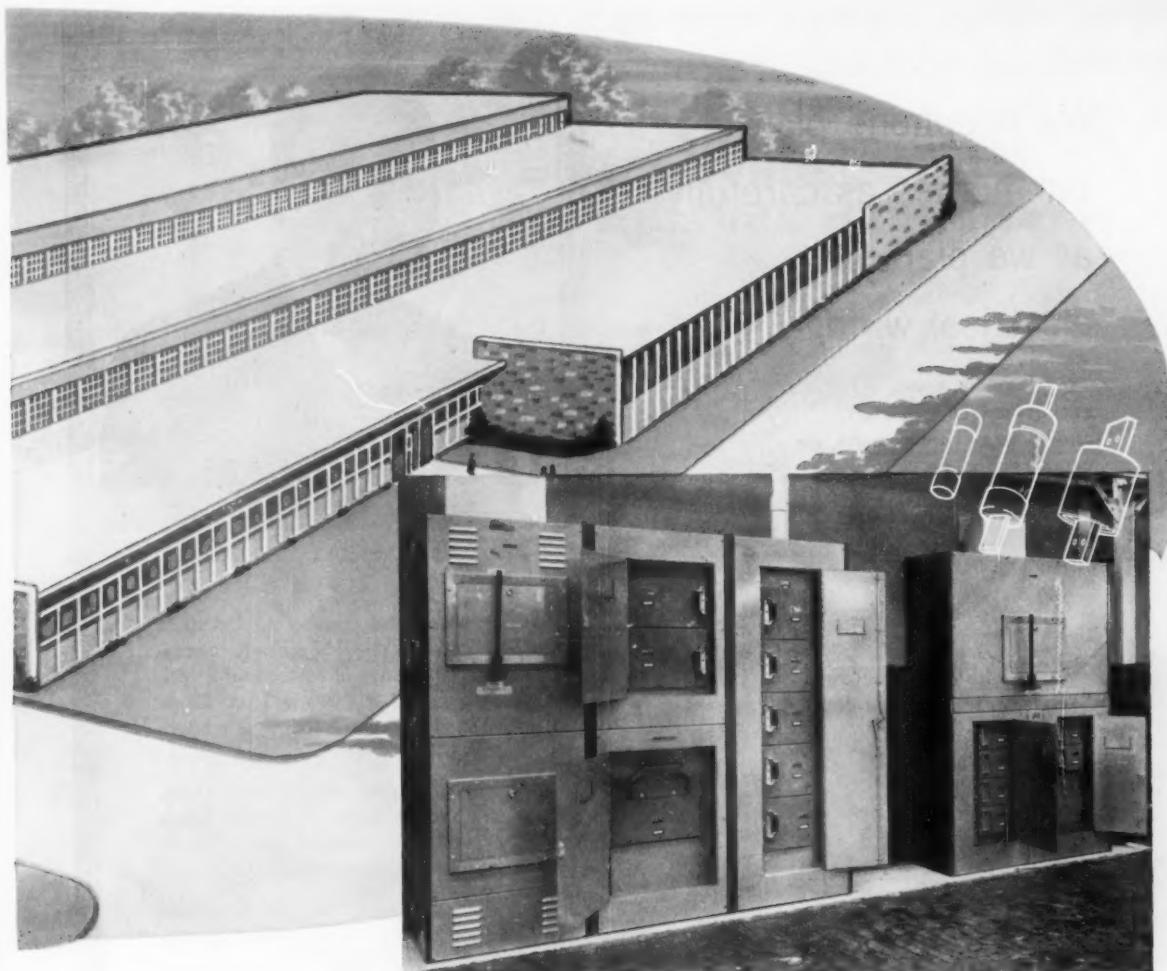
This plant will have many operating advantages because fuses are installed. *For instance:*

Future expansion without sacrificing safe protection.

Provisions were made to install a second 1600 ampere pressure switch when needed. This additional capacity and any increase in available fault current can safely be handled by BUSS Hi-Cap and FUSETRON dual-element fuses.

The interrupting rating of BUSS Hi-Cap fuses is 200,000 amperes rms symmetrical — and for FUSETRON fuses it is 100,000 rms symmetrical.

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION



Main Power Panels —
BUSS Hi-Cap and FUSETRON Fuses

Through the year's savings result from the greater dependability of fuses.

Unlike mechanically operated devices, a fuse has no hinges, pivots or contacts to stick or get out of order. Dust, fumes, corrosion or age cannot increase a fuse's capacity or lengthen its blowing time.

After years of service, a fuse will give the same safe, dependable protection if called upon to open as it would have given on the day it was installed.

The dependability of BUSS Hi-Cap and FUSETRON fuses helps to reduce costs — by preventing damage and loss due to electrical faults

— by being maintenance free — by requiring no periodic inspections — and by eliminating shutdowns caused by needless outages.

Is it any wonder then that "ELECTRICAL PROTECTION IS GOING MODERN WITH FUSES"? No other type of protective device can match the combined high-interrupting capacity, dependability and maintenance-free features of fuses.

For more information

On BUSS Hi-Cap fuses . . . Write for bulletin HCS.

On FUSETRON
dual-element fuses . . . Write for bulletin FIS

759

BUSSMANN MFG. DIVISION, McGraw-Edison Co. ST. LOUIS 7, MO.

**"We telephone plan
our homes as carefully
as we plan for
electrical wiring"**

**—SAYS DAVID S. BINNS,
EXECUTIVE VICE PRESIDENT,
BINNS VALLEY FORGE HOMES, INC.,
VALLEY FORGE, PA.**



This is "The Wingspread," a Valley Forge Mountain model home. Above, its spacious kitchen, with convenient telephone nook, is shown by Mr. Binns to telephone company representative Ed Hausner.

Thirty minutes west of Philadelphia lies Valley Forge Mountain, a gracious community of custom-built residences priced \$30,000 and up. These homes offer a complete line of modern conveniences.

Telephone planning is one of them. Each Valley Forge Mountain home has built-in, concealed wiring for 5 or more telephone outlets.

"People expect to find telephone planning in a quality home," says builder David Binns. "Our aim is to design and build completely *modern* homes—and planning for complete telephone flexibility is a necessary part of that concept. We telephone plan our homes as carefully as we plan for electrical wiring and other modern conveniences."

* * *

Your local Telephone Business Office will gladly help you with telephone planning for your homes. For details on home telephone installations, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

**BELL
TELEPHONE
SYSTEM**



ALLIS-CHALMERS

"Profit Line for '59"
Electrical Products from

ALLIS-CHALMERS

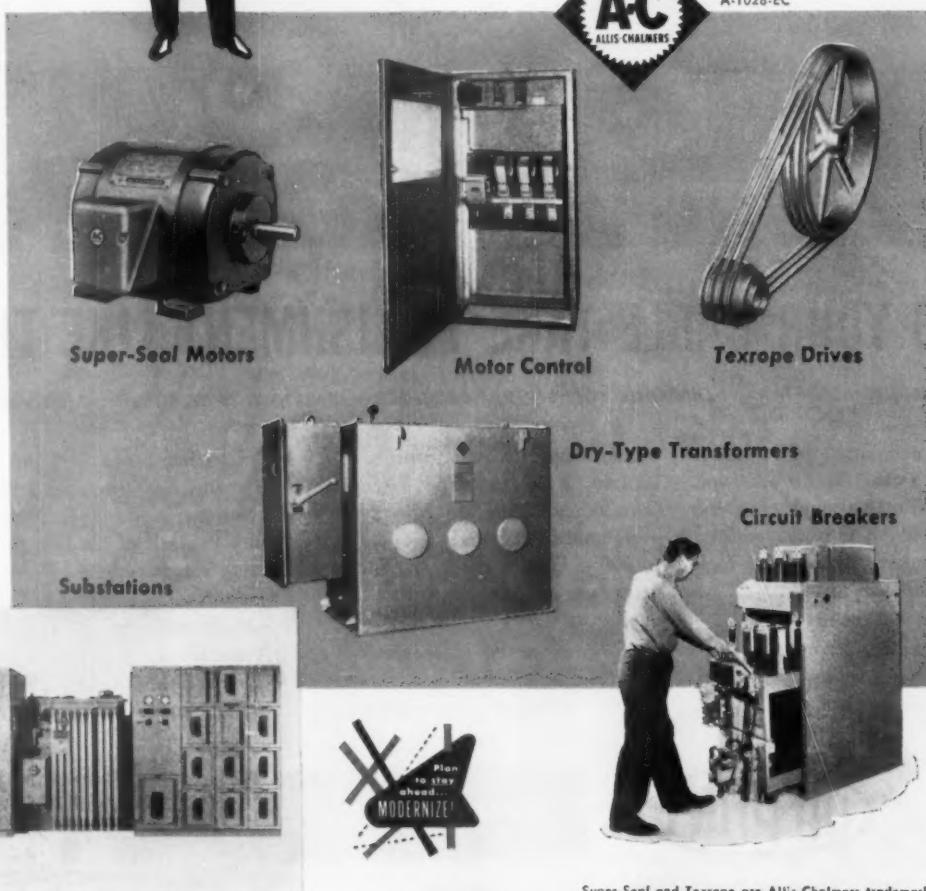
**ONE MAN can provide
ALL this equipment**



He's your Allis-Chalmers representative. *One inquiry* to him and much of the equipment you need for any electrical construction job is available.

Time and Money Savings for Extra Profits — because a single, dependable source means "unit responsibility" for deliveries, installation help, fast parts service. And, once installed, this equipment continues to be backed by outstanding field service — without "buck passing."

Ask "The Man" about the profitable A-C products for electrical construction. *Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.*



ALLIS-CHALMERS



COULD YOUR CABLE TAKE PUNISHMENT LIKE THIS?

Neoprene jacketing withstands rockslide, keeps strip-mining power shovel in service

Tons of rock and earth crushed down on a 500-foot section of this 5000-volt power cable. But the tough neoprene jacket withstood the impact... resisted tearing and gouging by the sharp rock... kept the cable in service.

In addition to impact resistance, neoprene jacketing gives electrical cable long-term protection against sun and weather, chemicals and soil acids,

oil and flame. Because neoprene is vulcanized, it will not flow. Neoprene-jacketed cable has proved serviceable even upon brief, intermittent exposure to 500°F. At the other extreme, neoprene can be compounded to remain flexible at -65°F.

Neoprene proved in service. With over 20 years of continuous service in many installations, neoprene has given

the lasting protection, the long-term economy now taken for granted when neoprene is specified. Next time, assure yourself of the best protection a cable can have. Specify time-proved neoprene jacketing. For more information write to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EC-7, Wilmington 98, Delaware.



Better Things for Better Living...through Chemistry

SYNTHETIC

RUBBER

NEOPRENE
HYPALON®
VITON®
ADIPRENE®

ALLIS-CHALMERS

The Profit Line for '59

ALLIS-CHALMERS

Exclusive electrical and manual stored-energy closing mechanism.



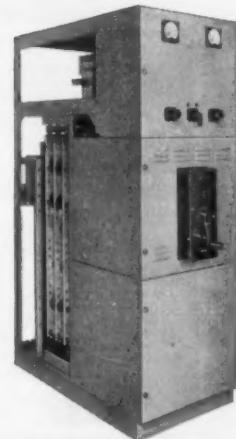
Convenience — control devices located on breaker front — safely available even with door closed.

Plus Value in every detail

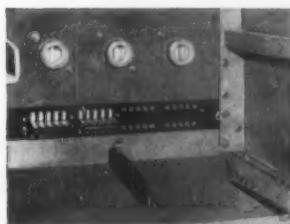
Allis-Chalmers all-new
600-volt metal-enclosed switchgear
for 75,000-ampere
interrupting service

Just a few of the operating... safety... and application features of A-C's new design are shown. There are many other features that will interest you, such as unitized construction, the use of polyester glass insulation, and spring-held dust seals.

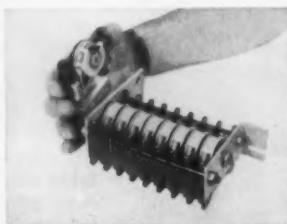
Get the details! Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



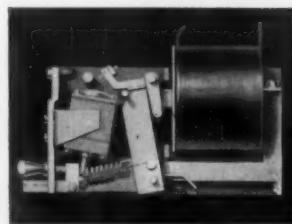
Safety — breaker shown in disconnected position... stored with door closed. The indicators show circuit breaker position.



Safety—(a) interlock prevents movement of closed breaker; (b) latch prevents rocking past disconnect position.



Flexibility—each stage of auxiliary switch assembly is individually adjustable without disassembly.



Accuracy—direct acting series-trip device is set easily, using calibration scale and adjusting knob.



A-1038-EC

ALLIS-CHALMERS



Sola Catalog No. 77-10-202
 constant-wattage transformer
 for two H1, H25 or H33-1
 400-watt mercury lamps—
 outdoor, weatherproof service



Sola outdoor mercury-lamp transformer is smallest, lightest two-lamp, constant-wattage unit

Reduced in weight from 70 to 48 pounds and in diameter from 8 $\frac{1}{2}$ to 6 $\frac{1}{2}$ inches, transformer Catalog No. 77-10-202 saves time, money and effort in shipping, handling, and installation. Improved operating characteristics result from a newly designed constant-wattage circuit combined with the use of Class-B insulation. Delivering ample open-circuit voltage for straight series operation of two 400-watt mercury lamps, the new model replaces series-sequence unit, Catalog No. 77046.

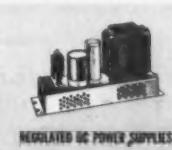
Performance improvements include a lower crest factor (peak/rms ratio) of lamp current. Reduction to a value of only 1.6 contributes to extended lamp

life as well as high lumen maintenance over the lamps' useful life. Less than $\pm 1\%$ variation in rated lumen output — even with line voltage fluctuations as great as $\pm 13\%$ — results from the new circuit's improved lamp-wattage regulation. The new two-lamp unit has an efficiency of 90%, with a transformer loss of only 80 watts.

The housing is a single-piece, deep-drawn case . . . hot-dip galvanized and completely sealed. Special neoprene-covered leads are brought out through a neoprene plug in the threaded nipple. The new Sola mercury-lamp transformer is absolutely weatherproof and watertight.

Full engineering details and performance data are available in new bulletin MVO-359. Write for your copy to the Manager, Lighting Sales.

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill., Bishop 2-1414 • Offices in principal cities • In Canada, Sola Electric (Canada) Ltd., 24 Canmotor Ave., Toronto 18, Ont.



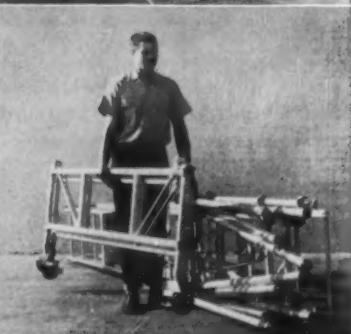
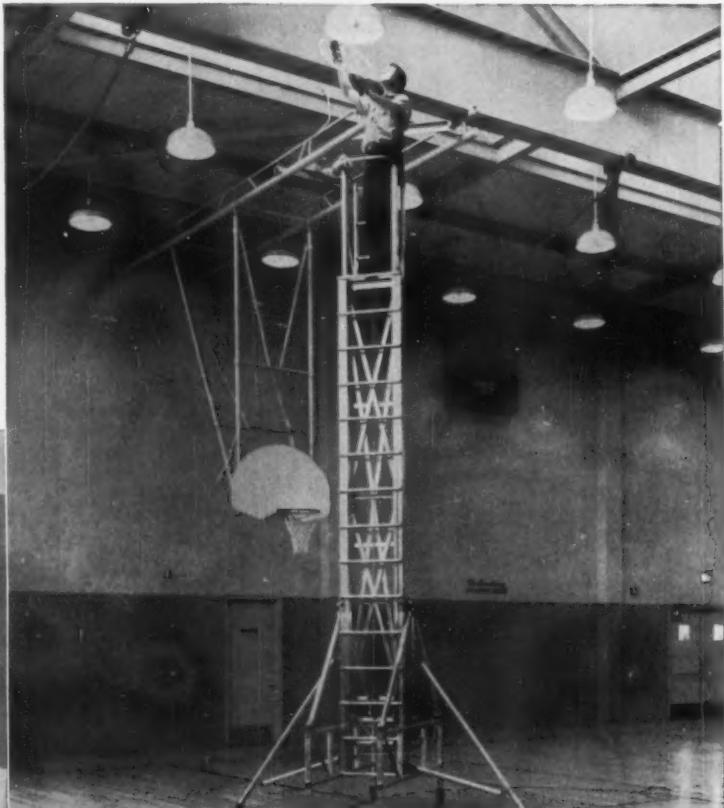
A DIVISION OF BASIC PRODUCTS CORPORATION

UP-RIGHT ANNOUNCES

TALL ESCOPE

...telescoping aluminum work platform for overhead construction and spot maintenance

Lightweight, rapidly assembled by one man. Extends instantly for reaching heights up to 30 ft. Telescopes for rolling under trusses and other obstacles. Adjustable legs for uneven floors or stairways.



Rolls through doorways . . . only 29" wide, telescopes and folds down.

Bridges over auditorium seats.

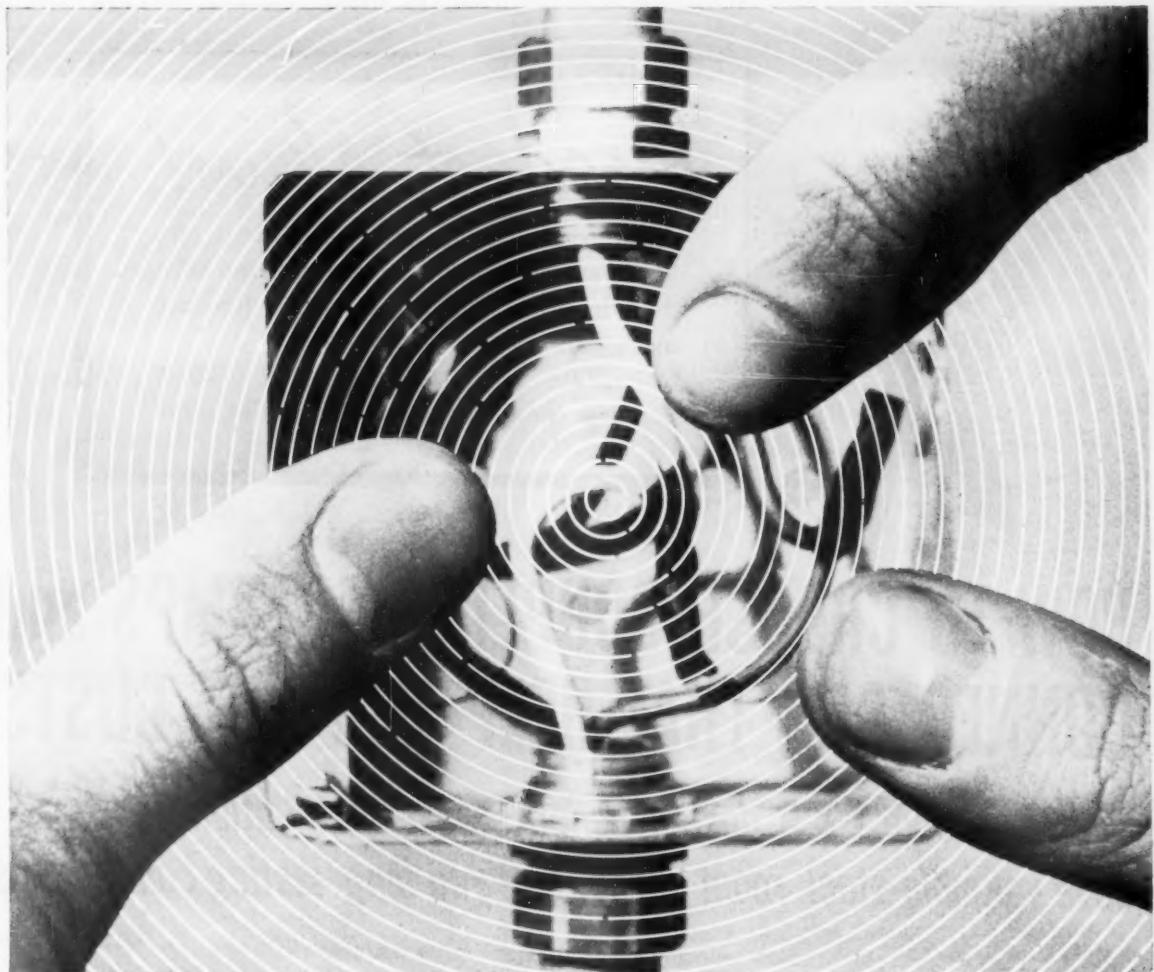
Separates easily into 3 components for convenient storage or transportation.



FOR TALLESCOPE CIRCULAR
WRITE TO
UP-RIGHT SCAFFOLDS
DEPT. 177 • 1013 PARDEE ST., BERKELEY, CALIF.

MANUFACTURED BY
**UP-RIGHT
SCAFFOLDS**





Take the Thumbs Out of Electrical Wiring With Improved J-M Dutch Brand Plastic Tape

makes every job easier, faster, more economical



Johns-Manville Dutch Brand Plastic Electrical Tape is now made even better! With its improved adhesive, Dutch Brand accomplishes every wiring job with new time-saving nimbleness. Rugged, versatile, it has what it takes to stick around in the "tight spots"—conforming to irregular surfaces neatly without bunching. Important too, Dutch Brand Plastic is now packaged in money saving, economical, convenient 44-foot rolls in addition to the regular 20' and 66'.

See why Dutch Brand Plastic is best for all your wiring assignments . . . Send for "Big Four in Electrical Tapes", the idea booklet that illustrates how you can do better electrical jobs.

Johns-Manville Dutch Brand Division
7800 S. Woodlawn Avenue, Chicago 19, Ill.

JOHNS-MANVILLE

JOHNS MANVILLE
JM
PRODUCTS

Reddy Fitter goes to market!



Product News!

To keep you informed about new fittings, and the ways in which standard fittings have been improved, T&B presents this "product news" ad.

Read it... see how advanced T&B product features can give you *lowest installed costs*.

HOW TO CHOOSE COUPLINGS, CLAMPS and CONNECTORS THAT HELP YOU CUT COSTS

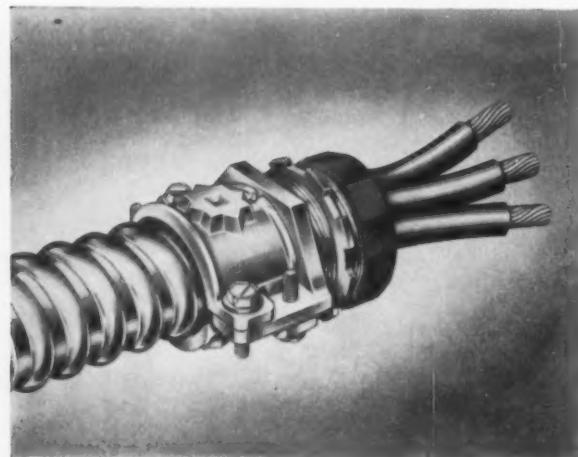
Exclusive T & B design benefits save installation time, save valuable stock room space, give you long-lasting connections

The T&B products shown here help you lower installation time and inventory requirements. They reduce the need for annoying call-backs by insuring permanent trouble-free connections.

Check with your T&B distributor the next time you order products like them. You'll

appreciate the profitable results.

To get all the details of the T&B story now, just mail the coupon. Or call your nearby T&B distributor. He'll be glad to tell you more about these quality fittings... show you how to get highest performance, *increased savings*, with them.



NEW INTERLOCKED ARMORED CABLE FITTINGS

Pat. Pend.

End problems of variations in cable size

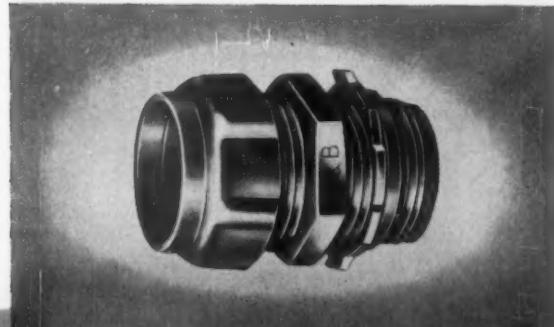
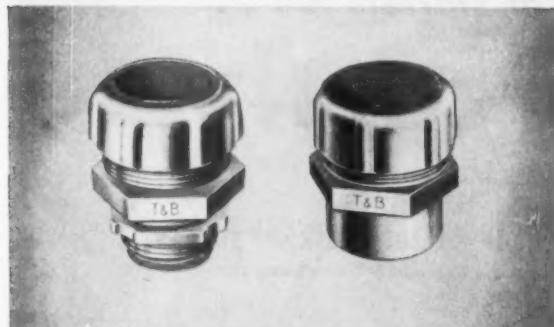
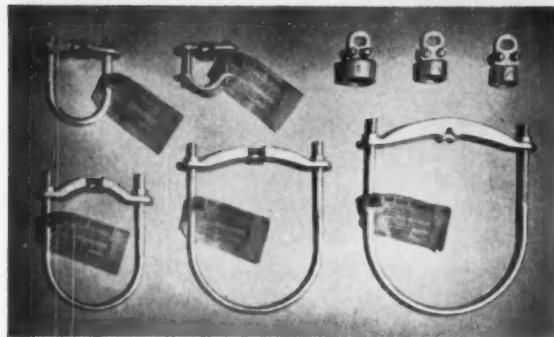
Here are *exclusive* advantages. 1) One connector for each knockout size. 2) Twin-saddle construction. Both saddles are independently bolted and serrated for positive grip against pullout. Cable is always centered, cannot "wow". 3) Extra armor stop in connector's throat means cut end of the armor is always adequately bushed. 2) & 3) permit these fittings to accommodate twice the range of cable sizes as competitive designs—and there's no chance of mis-matches.

**NEW****COMBINATION ENTRANCE HEADS**

Pat. Pend.

Multipurpose . . . easy to install

An exclusive inventory saving you will appreciate. Stock one Entrance Head for thinwall conduit, rigid conduit, service entrance cable. Entrance Head needs no separate spacer for thinwall conduit. Installation on Service Entrance Cable requires only a screwdriver and a few minutes. Entrance Head cover is lifted by loosening one screw. Bracket with female key easily attaches Entrance Head to wall or post.



All T&B products sold only through
authorized T&B Distributors

THE THOMAS & BETTS CO.
INCORPORATED

34 Butler Street, Elizabeth 1, New Jersey

Thomas & Betts, Ltd., Montreal, P. Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

**NEW****COMBINATION LIQUID-TIGHT
CONDUIT COUPLINGS**

Patented

Speed up installations

One fitting couples Liquid-Tight raceways to rigid conduit, eliminates the need for separate conduit couplings and liquid-tight connectors. You just thread the T&B combination fitting onto rigid conduit, then install the Liquid-Tight conduit. One-step method saves time, and the handling of separate parts assures tighter fit and tight oil seal, preserves continuity of ground.

INSULATED FITTINGS

Pat. Pend.

Tough fitting gives full protection

Tough, slippery blue insulator is an integral part of every fitting, reduces tug and pull by as much as 50%. Protects conductor insulation from abrasion at critical areas. Gives the protection required by UL, JIC and Machine Tool Wiring codes.

Please send more information on:

<input type="checkbox"/> NEW Combination Liquid Tight-Conduit Couplings	<input type="checkbox"/> Ground Fittings
<input type="checkbox"/> NEW Combination Entrance Heads	<input type="checkbox"/> NEW Interlocked Armored Cable Fittings
<input type="checkbox"/> Please have a T&B Distributor salesman visit me without obligation	<input type="checkbox"/> Insulated Fittings

Name.....

Firm.....

Address..... City..... State.....

For squirrel-cage, wound-rotor, and synchronous motors to 1500 hp



LOW-VOLTAGE INDIVIDUAL STARTERS

- 1 Arc chutes are easily removed for tip inspection, and all components can be quickly replaced if necessary.
- 2 Pre-installed protective devices save valuable installation time. General Electric circuit breakers are simple to reset, and CLF fuses can be quickly replaced.
- 3 Completely wired and assembled starter can be quickly installed. Simply connect incoming power leads and motor-control leads and motor can be put on line.
- 4 Air-break contactors have silver contact tips to give long operating life with a minimum of maintenance.



Write for bulletin GEA-6584 to Section 783-102,
General Electric Company, Schenectady, New York.

General Electric's complete line of starters is . . .

Faster, less costly to

For individual or grouped control of motors up to 3000 hp

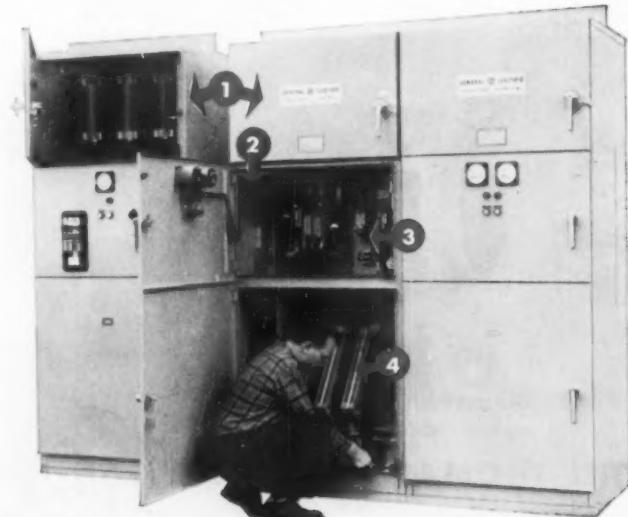
- 1 Individual or grouped control is obtained by installing 30-inch deep Limitamp starters as units or in lineups, mounted back-to-back or back-to-wall with a common power bus.
- 2 Ample space for cable entry is provided at top and bottom of unit. All installation wiring is made to conveniently located terminal boards.
- 3 Hinged low-voltage panel swings out for accessibility. Front-connected components are easy to maintain.
- 4 High-voltage contactor rolls out of enclosure. Low-voltage connections are plug-in type. Tip changing and a-c coil removal are fast and require a minimum of effort and tools.

For more information contact your G-E Apparatus Sales Office, or write for bulletin GEA-6331 to Sect. 783-102, General Electric Co., Schenectady, N. Y.



HIGH-VOLTAGE LIMITAMP* STARTERS

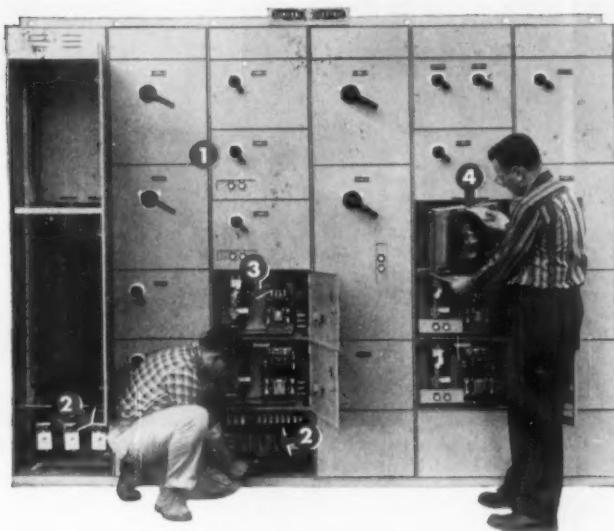
* Registered Trade-mark of General Electric Co.



GENERAL **ELECTRIC**



LOW-VOLTAGE MOTOR CONTROL CENTERS



For flexible, grouped control of motors up to 400 hp

- 1 All starter units in one structure eliminates grouping of individual starter enclosures and associated installation expense.
- 2 NEMA Class II construction has factory-wired and tested interconnections. To install, simply connect power and outgoing motor-control leads.
- 3 Front connected units are accessible for speedy inspection and maintenance of wiring and components.
- 4 Easily removable starter units reduce bench maintenance time. Speed latches expedite unit removal; hold units in place when engaged. Components are readily accessible from top, front, and sides when starter unit is removed.

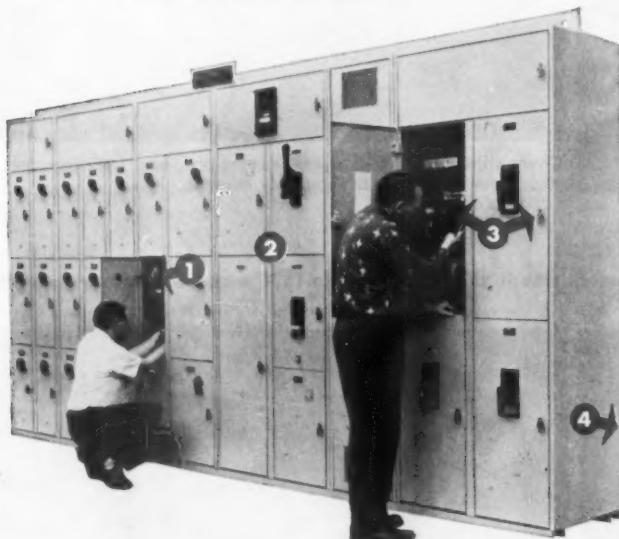
Write for bulletin GEA-4979 to Section 783-102, General Electric Company, Schenectady, New York.

install and maintain



LOW-VOLTAGE CABINETROL* POWER CENTERS

* Registered Trade-mark of General Electric Co.



For custom-engineered grouped control of motors up to 900 hp

- 1 Roomy starter compartments facilitate routine inspection and maintenance without removal of starter unit from compartment.
- 2 Custom engineered controls are supplied to specific application needs. Complete system is factory-wired and tested. Installation requires only connecting incoming power and motor-control leads.
- 3 Easily accessible components are mounted with ample room for adjustment and maintenance. Spring-latch door provides easy access.
- 4 Hinged, full-height rear doors allow inspection and testing of continuous process equipment without stopping the process.

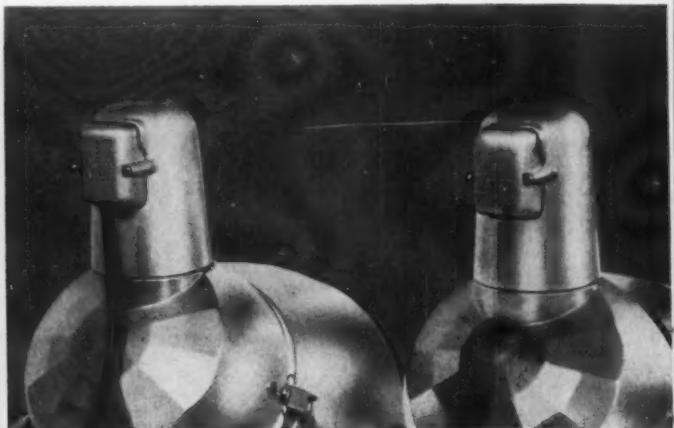
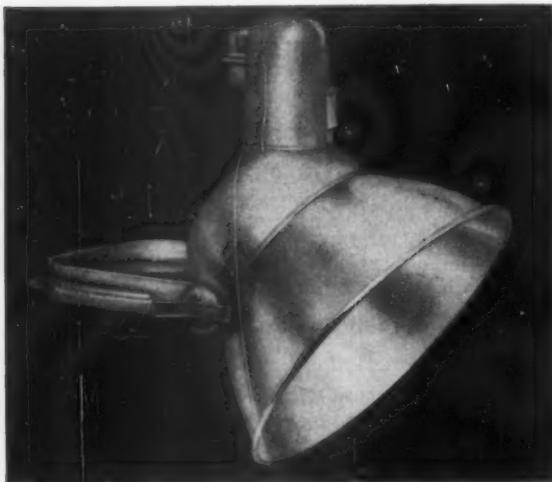
For more information contact your G-E Apparatus Sales Office or write for bulletin GEA-3856 to Sect. 783-102, General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC



MERCURY

Now, 100- to 1000-watt mercury lights give twice the light per watt, 2 to 6 times



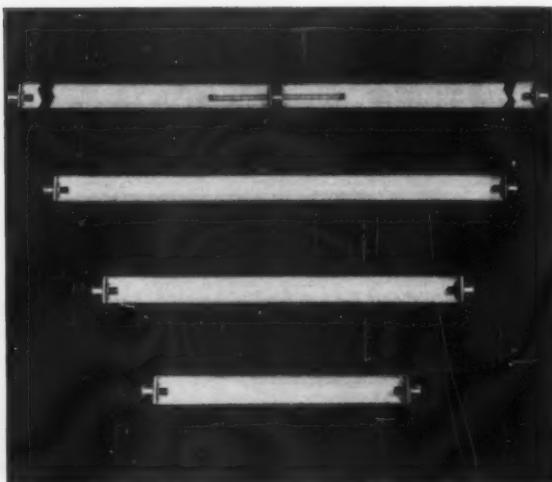
Wired or unwired—get the L-69A prewired, with 4-foot cable, or buy it unwired—to cut cost and splicing time.



FLUORESCENT

Fluoroflood* fixtures are available in 4-, 6-, 8-, or 9-foot lengths—for High

*Registered Trade-mark of General Electric Co.

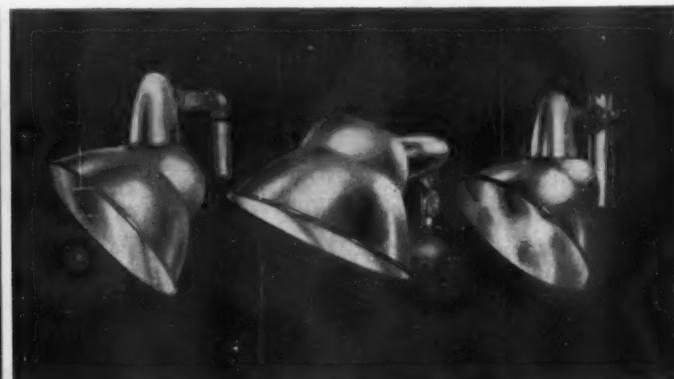
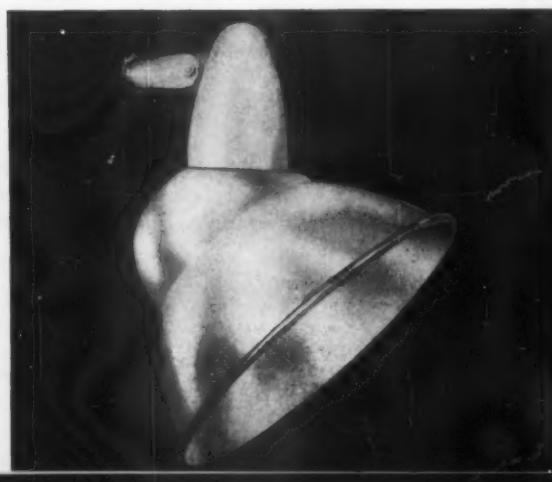


Cover slips out easily for simple relamping and maintenance—
regardless of position of mounting conduit.



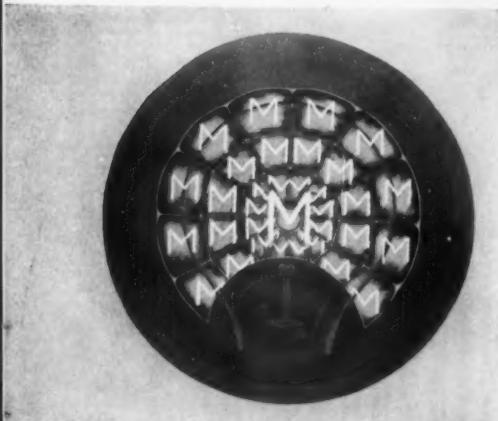
FILAMENT

A complete line of filament floodlights—from 250 to 1500 watts, includes a model for



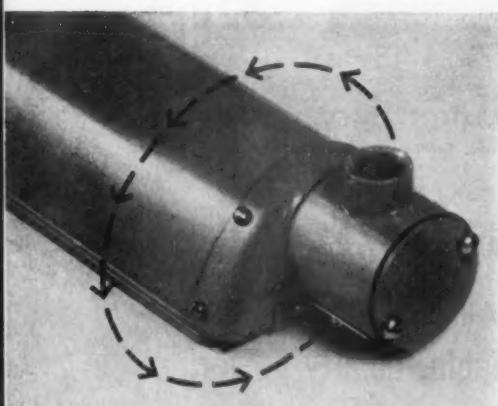
All angle mounting of L-100 and L-55 series (filament or mercury) made possible by threaded mounting stud and locknut.

longer lamp life than filament.



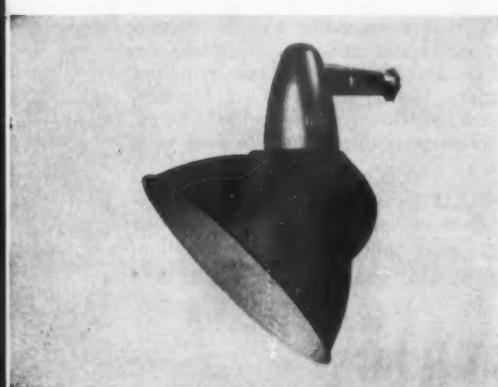
5% to 35% more light—more uniform distribution—with exclusive "diamond back" reflector.

Output or Power Groove lamps.

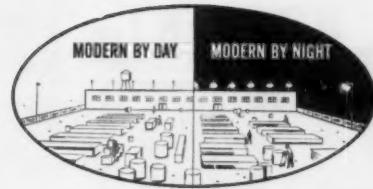


360° rotation of reflector permits mounting at any angle, aiming in any direction.

almost any application.



Economy model—L-55 open floodlight—features faceted one-piece porcelain reflector.



Only with General Electric floodlights can you choose from **ALL 3 LIGHT SOURCES** and get these important benefits

More light per unit, better distributed light—For example the optical design of General Electric's Fluoroflood fixture is specifically designed to deliver maximum light in a uniform pattern, eliminating "hot spots" and dim areas. For filament or mercury lighting, G.E.'s exclusive "diamond back" reflector—featured on our L-69A, L-55, and L-100 units, delivers from 5% to 35% more light—light that is usually lost behind the lamp with ordinary fixtures.

Fast installation, practically no maintenance—Sturdily designed G-E floodlights are fast and simple to mount, aim, connect, and maintain. The external terminal box on the L-69A (mercury or filament) makes wiring faster and simpler, insulation life is increased many times. The Fluoroflood fixture offers easy access to wiring and complete flexibility in mounting and aiming. Since the reflector can be rotated 360°, you can mount it at any angle, aim it in any direction. Installation and maintenance are greatly simplified since the unit consists of only two end castings with lamp-holders and a reflector.

Availability from many distributors' stocks—Coast to coast, more than 500 electrical distributors are franchised to supply General Electric floodlights from stock or by prompt shipment. Remember, General Electric premium quality floodlights cost no more than ordinary floodlights.

Call in your G-E Distributor today for the complete story—or send in the coupon below.

GENERAL  ELECTRIC

Section B450-14, General Electric Company, Schenectady, N. Y.

Please send me free information on the subjects checked below:

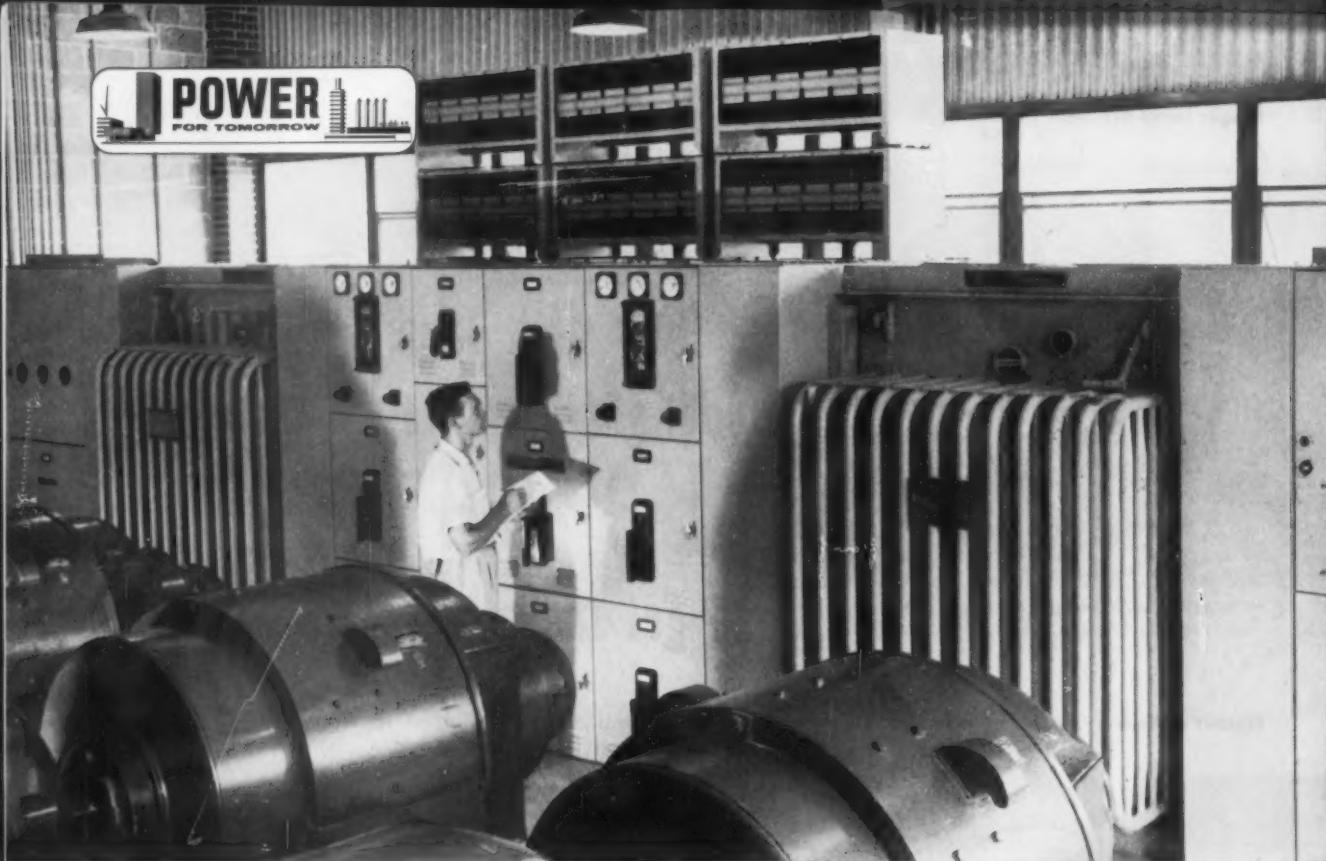
<input type="checkbox"/> Filament Floodlighting	<input type="checkbox"/> Fluoroflood Fluorescent Fixture
<input type="checkbox"/> Mercury Floodlighting	<input type="checkbox"/> Floodlighting Application Manual

Name _____

Company _____

Street _____

City _____ State _____



BUILDING BLOCKS OF POWER, load center unit substations, can be added easily to existing system to handle new load.

This keeps capital investment at a minimum. G-E shunt capacitors in racks improve power factor, save on power costs.

SAVINGS UP TO \$30/KVA!

**Boost plant power NOW with General Electric
480Y/277-volt equipment. It pays off in reliable, quality power.**

Converting to a reliable G-E 480Y/277-volt distribution load center system represents a profitable alternative to continued patching of an old installation, and can be carried out on a step-by-step basis over a period of time. Here are good reasons why:

RELIABLE SYSTEM performance depends on component reliability and built-in product features. General Electric unit substations incorporate standardized components manufactured under rigid quality-controlled conditions. Yet G.E. offers you a wide choice of units with capacities and ratings virtually custom-engineered to satisfy your requirements. These units, and other system components like metalclad switchgear, plug-in busway and transformers are designed for easy installation, or relocation to handle load density shifts.

QUALITY POWER is essential for efficient production, longer equipment life and power bill economies. One way that General Electric 480Y/277-volt systems help accomplish this is by using shunt capacitors to improve

power factor. Service-proven G-E Pyranol® liquid-filled capacitors—located close to loads—reduce system losses and increase system capacity as much as 20% or more.

FIRST-COST DOLLAR SAVINGS are realized with General Electric high-voltage power distribution systems because fewer, smaller conductors and circuit breaker components are needed. Savings increase substantially . . . up to \$30 per kva . . . where feeder lengths exceed 200 feet. You also cut engineering and installation costs. G-E primary switchgear and unit substations are factory-assembled in large sections for easy handling and fast installation. Outstanding product features, coupled with General Electric's system-engineering services, simplify purchasing problems and protect your system investment.

WRITE FOR FREE BULLETIN on General Electric 480Y/277-volt power distribution equipment, or contact your local G-E Apparatus Sales Office for more information. General Electric Co., Sect. 630-17, Schenectady 5, N. Y.

GENERAL  **ELECTRIC**

NEW upward revisions in RLM Specifications make it more important than ever to

Specify **RLM QUALITY** industrial lighting fixtures



be sure to get the **RLM**
high fixture quality required to
UP-LIGHT to the new higher **I.E.S.**

Recommended Industrial Lighting Levels...

Q Why is the **RLM Label**
today more important than ever in
"UP-LIGHTING" industrial operations?

A Because the **RLM LABEL**
stands for the highest
certified quality standards for construction and performance in
industrial lighting equipment. The recently published much
higher Illuminating Engineering Society's Recommended
Industrial Lighting Levels make quality equipment
MORE IMPORTANT THAN EVER. The latest in illumination
principles such as are assured by the RLM Label are vitally
important to comfortable seeing at the new higher levels.

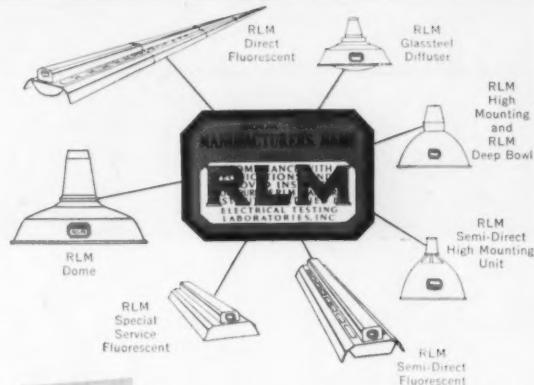
Q What is the **BEST WAY TO**
BEGIN a modern Up-Lighting Plan?

A Send for the **NEW RLM**
1959 EDITION
SPECIFICATION BOOK

featuring these quality advances!

1. All RLM incandescent units
Now "ALL WHITE!" Effective July 1, 1959!
2. New Uplight Incandescent units Specs!
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Please send the **FREE 1959**
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When "GOOD ENOUGH" isn't enough

use **TRIANGLE CONTROL CABLE**



Failure in a control cable is a messy business. The fault is hard to find, and operations must stop until it is found. That's why contractors and engineers don't use just a "good enough" cable. It's those vital links—they want the best. Many now guarantee this by specifying and using Triangle Control Cable.

But, there is no such thing as *one* all-purpose control cable construction. That's why Triangle makes these five general types—each designed for a particular set of circumstances:

1. **Rubber insulated, braid covered**
2. **Rubber insulated, Trioprene sheath**
3. **Rubber insulated, lead sheath**
4. **Trioseal insulated, Trioseal sheath**
5. **Triolene insulated, Trioseal sheath**

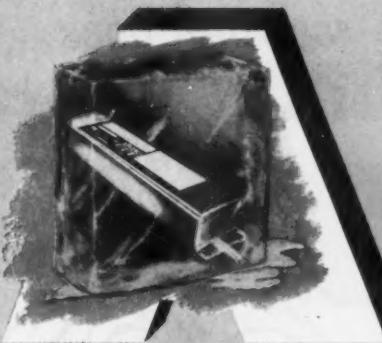
These are available in conductor sizes 14 to 9 with 1 to 37 conductors. Special types to meet unusual conditions are made to specifications. Types of control cable are available for aerial, conduit, tray, underground duct and direct burial installations.

*Informative technical literature is yours for the asking.
Write for your copy of our Control Cable Bulletin.*

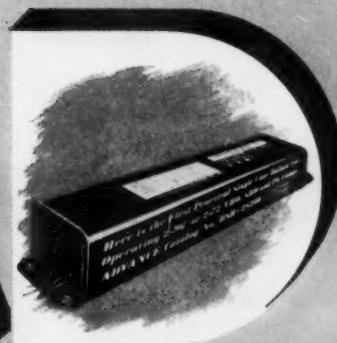
TRIANGLE CONDUIT & CABLE CO., INC.
NEW BRUNSWICK, NEW JERSEY
"It MUST Be Right!"

1sts

from
the world's
largest
exclusive
fluorescent
lamp ballast
manufacturer



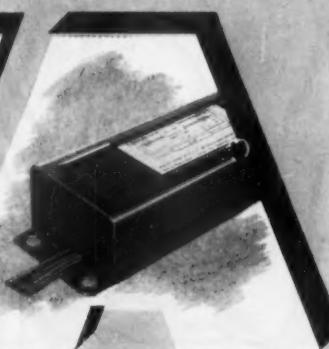
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FLUORESCENT LAMP BALLASTS



SINGLE CASE BALLAST
TO OPERATE VHO, SHO, PG LAMPS



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PROTECTIVE DEVICE



USA-VOLT[®] COLOR CODED LABELS FOR
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INDIVIDUAL PACKAGING OF
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LAMP BALLAST MANUAL



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FLB SERVICE
WARRANTY PROGRAM

"The Heart of the Lighting Industry"



ADVANCE[®]

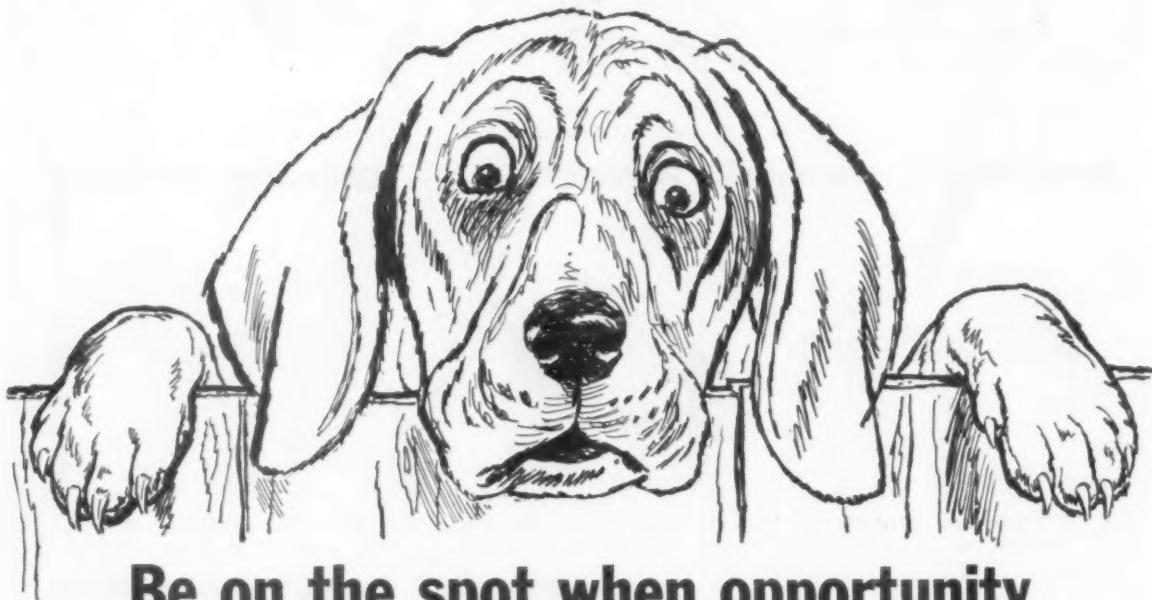
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World's Largest Exclusive
Manufacturer of
Fluorescent Lamp Ballasts

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*where
was my boss
when
that job
came up?*



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Send me the book "Dodge Reports—How to Use Them Effectively" and let me see some typical Dodge Reports for my area. I am interested in the general markets checked below.

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Area _____

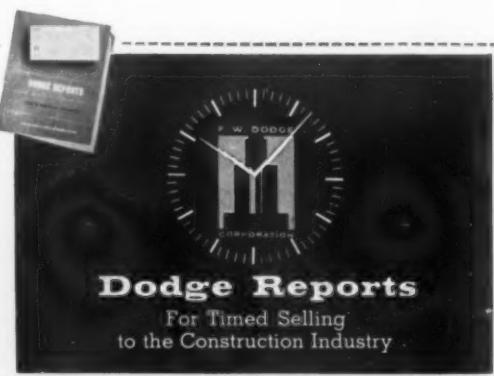
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Company _____

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City _____

Zone _____ State _____



Diamond has all portable cords

3

Red-D-Prene®

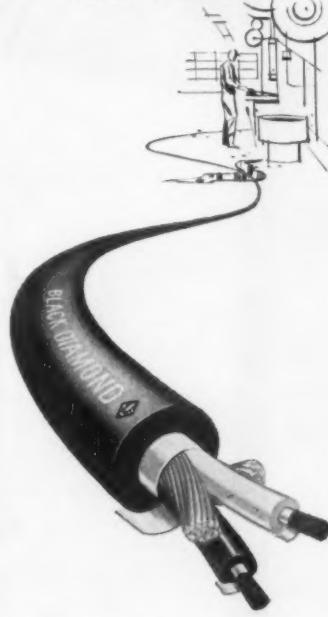
Neoprene Sheathed



for hot, oily locations

Black Diamond

Rubber Sheathed



for general purpose use

Signal Yellow

Thermoplastic



for all locations where heat
is no problem



Red-D-Prene for mill and plant use is designed with tough, oil, heat and flame resistant Type MD (Mill Duty) neoprene jacket in industrial red for ready identification.



Black Diamond has durable rubber jacket protecting against alkalis, acids and moisture. Very flexible construction prevents kinking in service.



Signal Yellow has a jacket of yellow thermoplastic that is quickly seen... clean to handle... smooth sheath will not readily collect dirt. Easy to pull.

DIAMOND IS ALSO A PRIME SUPPLIER OF



DTW Small Diameter
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DTX® Non-Metallic
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ABC Armored
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Range Cord Sets



DIAMOND

WIRE and CABLE Company

Sycamore, Illinois

WAREHOUSE: BIRMINGHAM, ALABAMA



Porter[®] VINYL TAPE



**Unqualified approval
by Westinghouse
Refrigeration Division!**

Porter Vinyl Tape has been tested to meet the tough Westinghouse specification for use in new refrigerator-freezer combinations, and has received unqualified approval on every point.

Westinghouse rated tapes on the following points: Breaking strength • Adhesion • Low- and high-temperature properties • Staining • Moisture-resistance • Elongation • Odor • Dielectric strength • Effect on polystyrene—and Porter met the spec's on every count!

Special new winding and slitting techniques keep Porter Vinyl Tape from telescoping on the roll, and help save space in tight spots where compact winding is essential. Another feature is its self-extinguishing property—it will not support combustion.

Get complete information by writing *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*

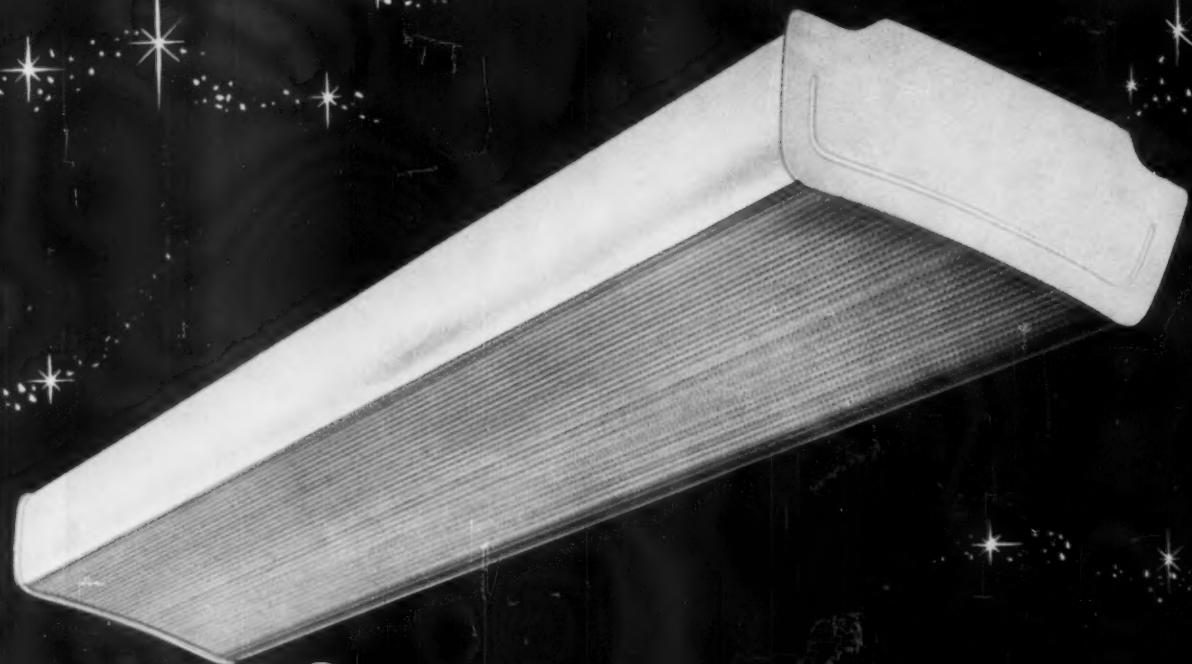


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H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Copper and Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepco" Systems—H. K. PORTER COMPANY (CANADA) LTD.



PREMIUM *Quality* IN THE GARCY TRADITION

AVAILABLE NOW AT A LOW-BUDGET *Price*

The New *Gar-Lite* 101 by GARCY LIGHTING

Exclusive one-piece shield combines two tones, does two jobs

Diffuse white sides prevent objectionable side brightness

Clear prismatic bottom offers controlled high efficiency

Shield hangs down from either side on continuous hinge

Two-lamp unit (illustrated) is less than 9" wide, 3 $\frac{3}{4}$ " deep

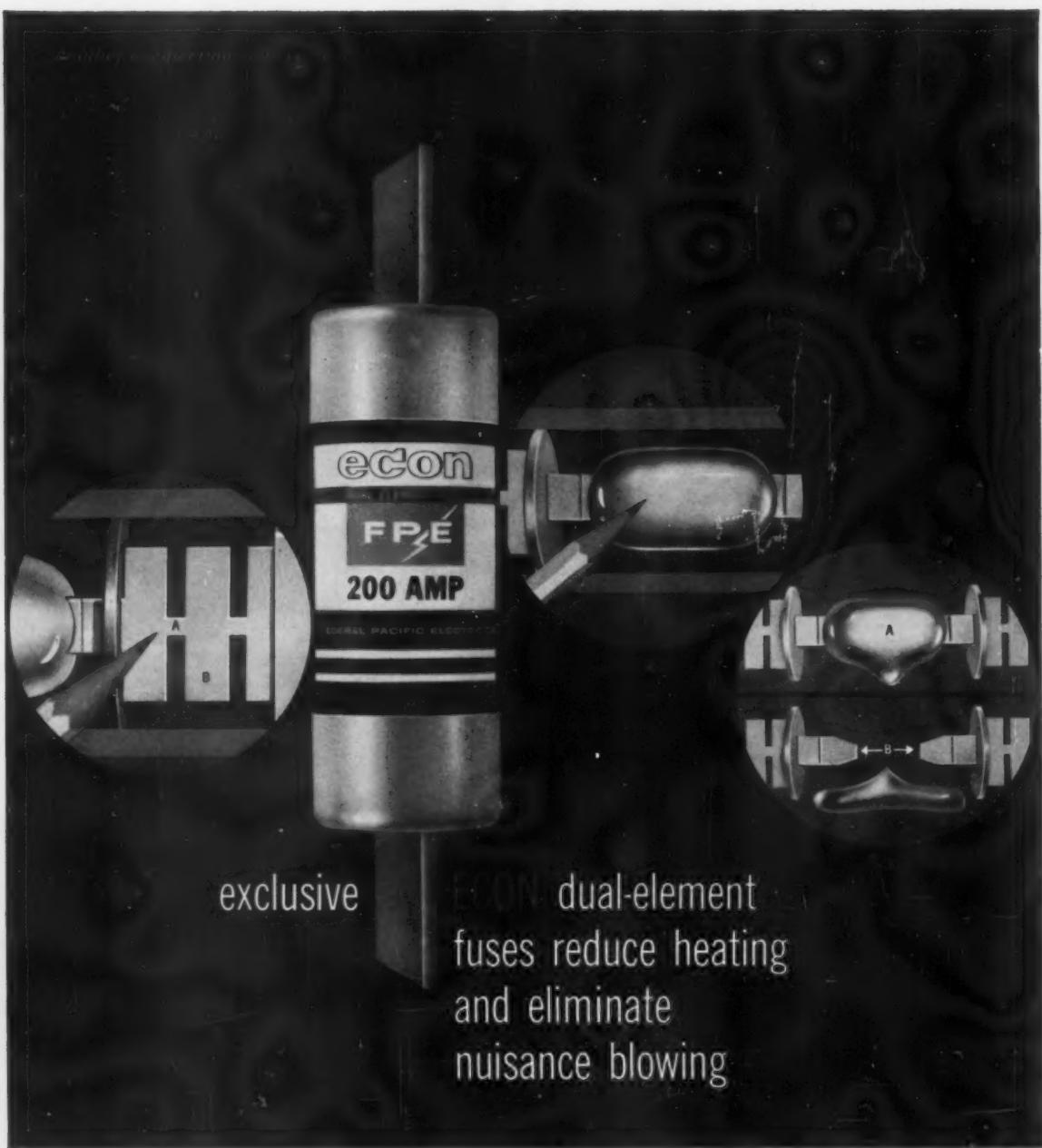
Exact 48" length; joins end to end quickly and easily

Write for Bulletin 59

AVAILABLE THROUGH SELECTED GAR-LITE DISTRIBUTORS

GARCY LIGHTING

DIV. OF GARDEN CITY PLATING & MFG. CO.
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exclusive ECON dual-element fuses reduce heating and eliminate nuisance blowing

Using an exclusive thermal-alloy element which reduces complexity and improves reliability—ECON Dual-Element fuses blow only when they are supposed to blow. You get: Positive protection of equipment...minimum fuse replacement costs...reduced downtime. Loose or corroded connections which cause high temperatures open ECON Dual-Element fuses before the temperature can become destructive. Result—cooler operation. Available in Knife Blade or Ferrule type from 0 to 600 amps, 250 and 600 v. For complete details write: Economy Fuse Division, Federal Pacific Electric Company, Dept. 336, Chicago, Illinois.

1. INSTANTANEOUS ACTION ON SHORT CIRCUITS—Fuse links at either end open the circuit immediately when a dangerous "short" develops. Fuse links (A) melt away instantly causing heavier sections (B) to drop away, completely interrupting circuit.

2. TIMED DELAY ON MOMENTARY OR HARMLESS OVERLOADS—Exclusive ECON-Alloy thermal element takes harmless overloads up to 500%...calibrated delay action prevents needless fuse blowing...unnecessary downtime.

3. QUICK, POSITIVE ACTION ON DANGEROUS OVERLOADS—When overload exceeds predetermined heat and time limits, ECON-Alloy (A) changes instantly from solid to liquid, positively interrupting circuit. NOTICE: EXTRA WIDE GAP (B) PROVIDES "SAFE-BREAK" DISTANCE...PREVENTS ARCING.

FPE **ECONOMY FUSE DIVISION** **CHICAGO, ILLINOIS**
FEDERAL PACIFIC ELECTRIC COMPANY

Three Important Signal Systems from Honeywell!



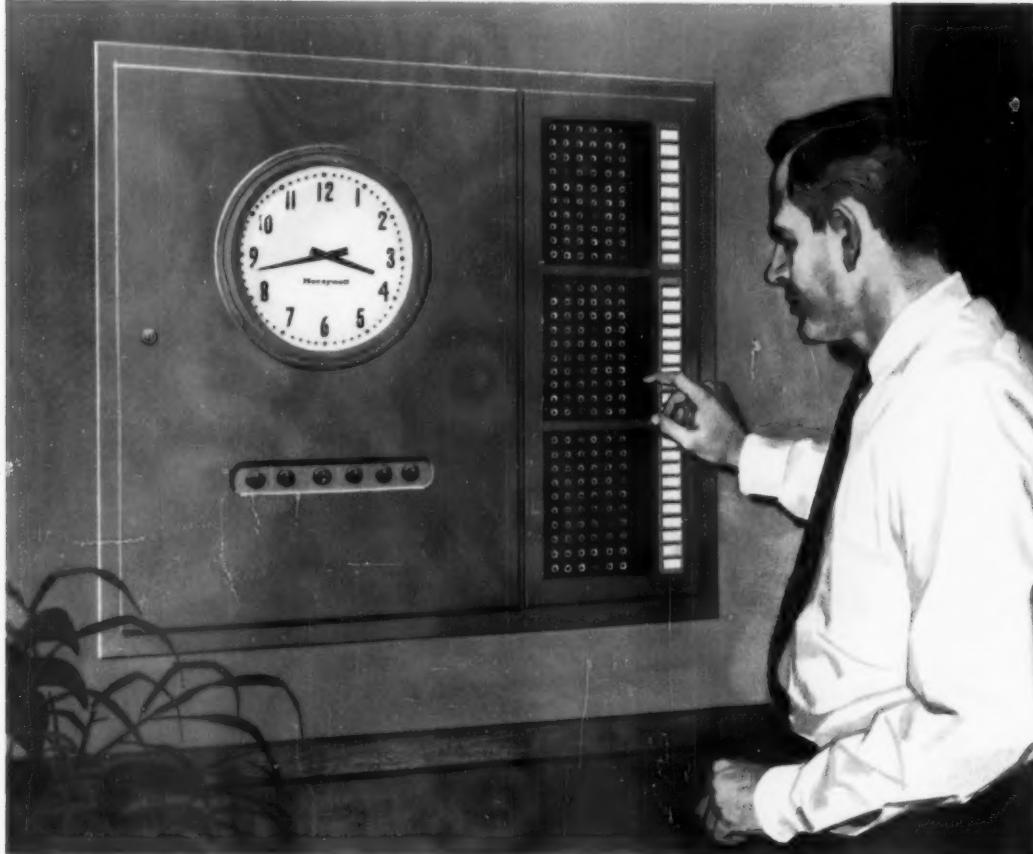
Clockmaster Time and Programming Systems



Fire Detection and Alarm Systems



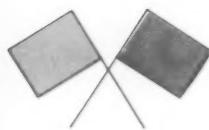
Surveillance Alarm Systems



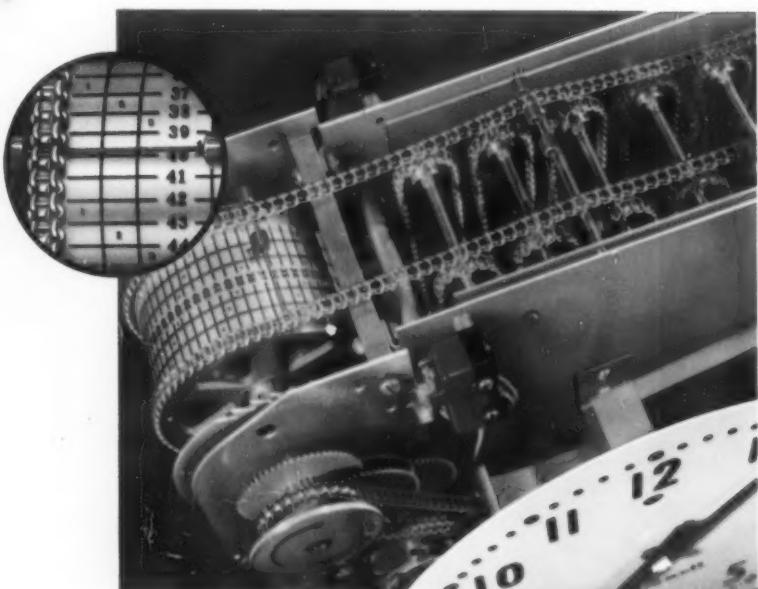
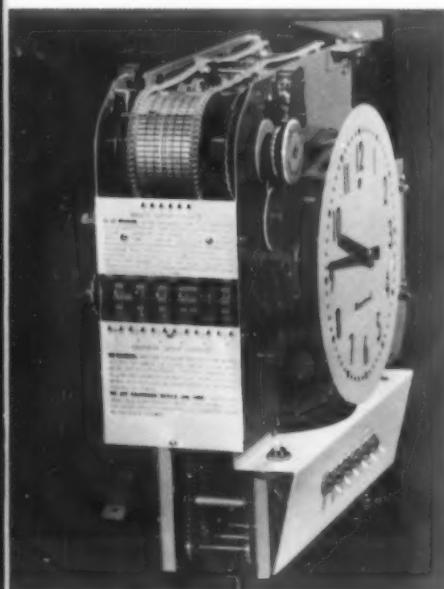
Honeywell Clockmaster® Systems are available in either synchronous wired or minute impulse types. In both systems Honeywell furnishes flush or surface mounted clocks in 9", 12", 15" or 18" dials. Both systems are self-correcting every hour with independent correction for each clock in the system.

A switch on the master clock permits substituting

manual switching or silence instead of automatic programming. Quick-change calendar device permits silencing any circuit during any 12 hour period of the week. A spring power unit is available for emergency use during power failure. Honeywell's system is especially wanted in schools because it offers the easiest-to-set programming on the market. • • • • •

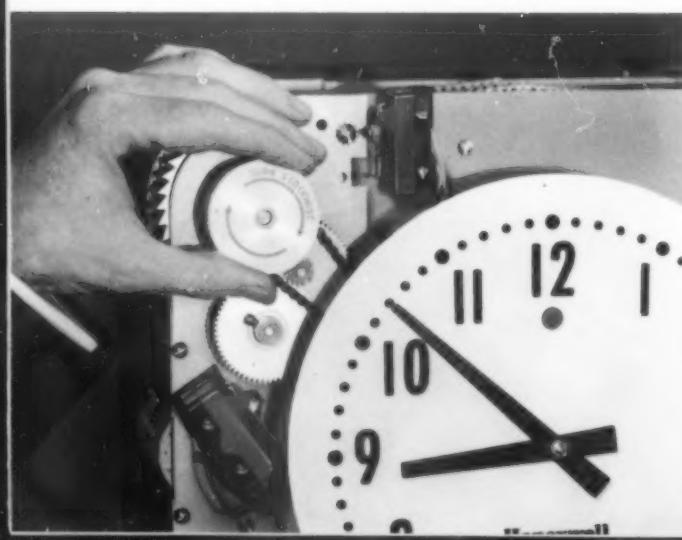


Here's why Honeywell Clockmaster Programming is the easiest to set!



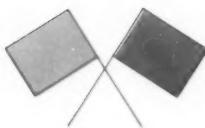
Easy-to-set signal drum. Honeywell's Clockmaster eliminates fuss and bother from program setting. Just turn signal drum to time, slip steel pin through chain links and slide on one of the reusable plastic rollers. To change signal, roller can be shifted without affecting any other part of the program. Special round pin-in-square-hole construction holds each signal roller firmly in place.

Easy-to-read numbers: Link chain ruggedness. Numbers on the signal drum are large, easy to read, and never confuse the program setter. Two precision link chains, color-coded for day-night identification, guide the entire program whether it includes three circuits or six. Chains are rated at twenty times load for insurance against breakage. Chains run continuously over idler gears. No piling at bottom of cabinet.



Dial-it clockwise program unit. Master time and master signal units are positively linked together. No chance for them to get out of step. When a program is set, the time setting knob is turned. As the clock hands reach the desired time, the program drum turns, too. In the same way, if power is interrupted, programmer runs on spring power with the master clock. When power is restored, signals again are right on schedule.

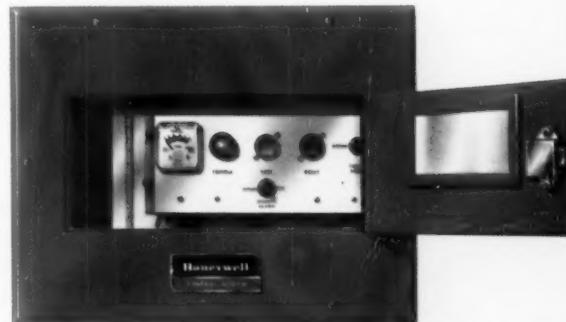
Honeywell's complete fire detection and alarm equipment offers greater flexibility... one reliable source!



Detector



Manual Station



W247 Panel

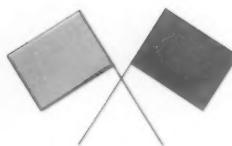
Now depend on one reliable source, Honeywell, for a fire detection and alarm system to meet the requirements of any building. Honeywell furnishes manual, automatic and sprinkler-water-flow systems, singly or in combina-

tion, furnishes all components, too—panels, detectors, manual stations, switches, bells, horns and buzzers. They're all built to rigid quality standards—all backed by Honeywell and famous Honeywell service.



Numbered lights identify a fire's location with Honeywell's W237 panel. This enables a supervisor to direct immediate fire fighting measures. Other features of this system include electrical supervision of the detecting circuit. Trouble signal and light indicate any wiring break. Signal may be silenced until repairs are made but trouble light stays on. Alarm will sound even if there is a break in the detecting circuit. And entire system may be tied in to local fire and police headquarters.

Honeywell's W247 panel uses a 2-wire circuit designed so that both detector and alarm circuits are electrically supervised. Any wiring break is immediately indicated by a trouble signal. If system is connected to a municipal alarm, a switch disconnects it during fire drills. Features large bell capacity—up to 5 bell circuits operating a total of up to 50 bells.



Honeywell Surveillance Alarm Systems

help prevent breakdowns of critical equipment

with economical one-man supervision

Wherever important operating equipment is scattered throughout a building or group of buildings it requires frequent checking. However, it needs actual maintenance attention only if there is trouble. Honeywell Surveillance alarm system replaces intermittent personal checking with continuous automatic supervision of boilers, compressors, tank levels, fans, motors and other critical equipment.

Red lights identify and locate trouble. Panel supervisor at central location can communicate with maintenance men who will correct trouble before it becomes extensive enough to cause a breakdown.

Unique circuitry permits a single pair of wires to carry warning signals from several pieces of equipment in the same area and to provide emergency communications with the area.

All connecting wires are electrically supervised so that any wiring break sounds a trouble signal. Thus the system supervises itself as well as the equipment it guards.



EVERY SYSTEM BACKED BY HONEYWELL'S UNIQUE MAINTENANCE AGREEMENT

With every one of these Honeywell Signal Systems, Honeywell offers a unique maintenance agreement to the owner. For a low annual cost, Honeywell provides periodic maintenance and inspection by factory-trained experts.

Parts and repairs, if ever needed, are provided at no additional cost. Emergency calls answered without charge.

And it's backed by 112 Honeywell sales-service offices throughout the country which bring service personnel within reach of any installation.

For more information about this Honeywell Maintenance Agreement or about any of the systems described here, call your local Honeywell office. Or write Honeywell, Dept. ES, Mpls. 8, Minn.

Honeywell



First in Control

Tape it easy, Mac!



Gold Seal Tape splices neatly, fast

It has high dielectric strength without bulk — a big advantage in many splicing jobs. It's elastic . . . easy to mold into a neat, thin wrapping. Just what the doc ordered for cramped areas, but we birds see more Gold Seal used for insulating cable splices than any other tape. High service line or terminal box, quality and convenience *talk* — and that's Gold Seal Plastic Tape, in the handy 20 ft. roll. Try it! Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

Gold Seal Tape

IN HANDY 20 FOOT ROLLS

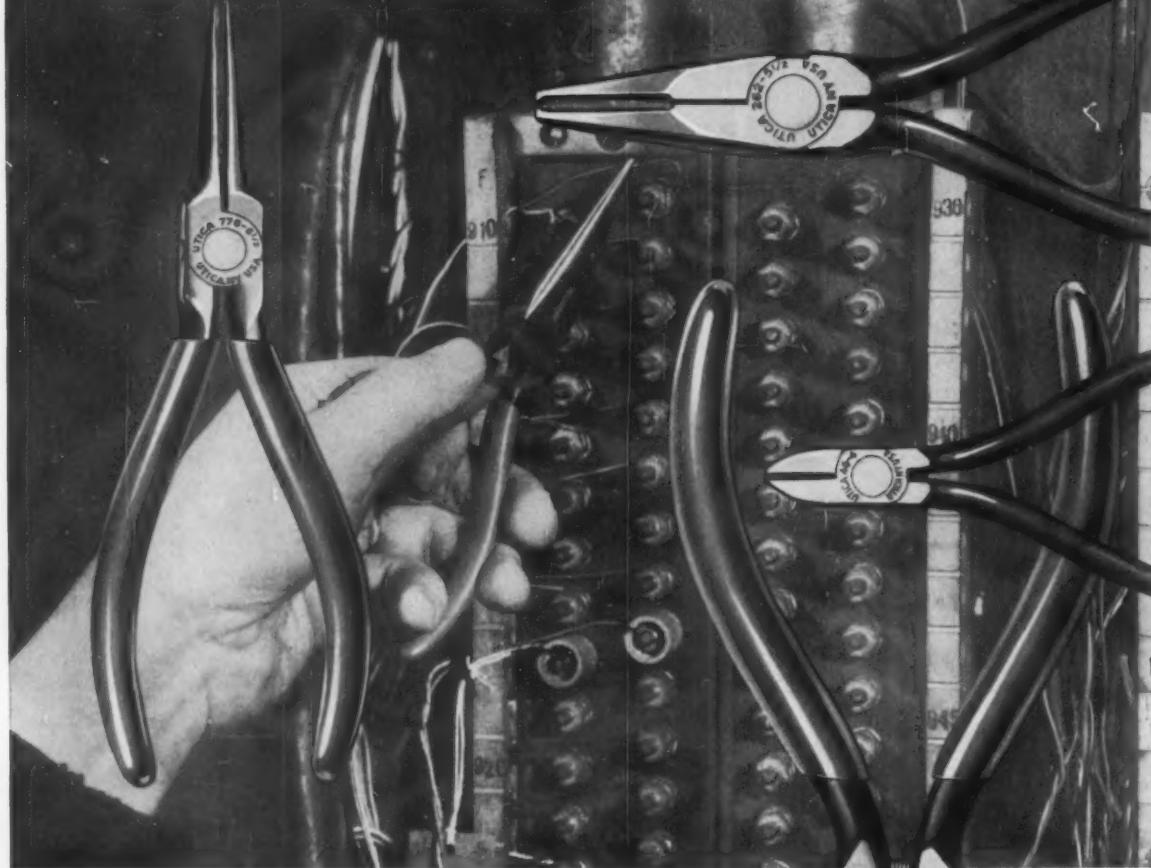
Gold Seal FRICTION — RUBBER — **PLASTIC** Tapes . . . Commercial and Specification Grades

Ten 20 ft.
rolls
in the
Handy Pack
can
Single 60 ft.
rolls
in individual
metal cans



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over 170 different pliers from stock



the right tool means a better job

That's why Utica offers such a broad range of standard tools—hundreds of pliers, wrenches and other hand tools direct from stock. And to keep pace, Utica is continually developing special and custom tools for the changing needs of industry. If your operation should suddenly call for a special plier or wrench, confer with your Utica Distributor. Counseling on the use and development of new and special tools is a regular part of his business.

Utica Drop Forge & Tool Division, Kelsey-Hayes Co., Utica 4, N.Y.



USE UTICA...the tools the experts use!

Hallmark of Quality since 1895



UTICA DROP FORGE & TOOL DIVISION • KELSEY-HAYES CO., UTICA 4, NEW YORK

Cutler-Hammer Three-Star Motor Control

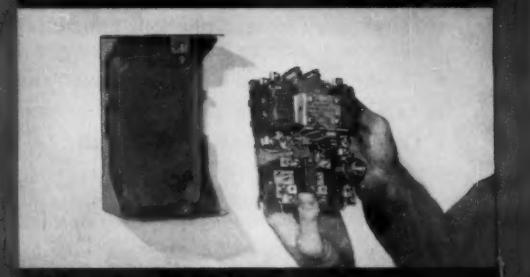
★ **Installs easier**
★ **Works better**
★ **Lasts longer**

★ The cost of installing motor control is almost always greater than the cost of the control. That is why Cutler-Hammer engineering made "easier installation" a key objective in the design of Cutler-Hammer Three-Star Motor Control.

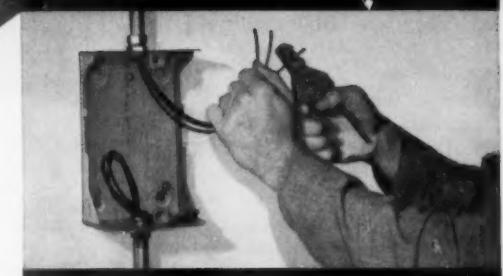
Compare the many outstanding design features of this control with any other and see how you can get the job done in less time with less cost to you and your customer when you install Cutler-Hammer Three-Star Motor Control. See your nearby Authorized Cutler-Hammer Distributor . . . he stocks all needed types and sizes of Cutler-Hammer Three-Star Motor Control. Also, write for the Cutler-Hammer Merchandiser, Pub. EA-100-N-241, the handy motor control selection guide. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.



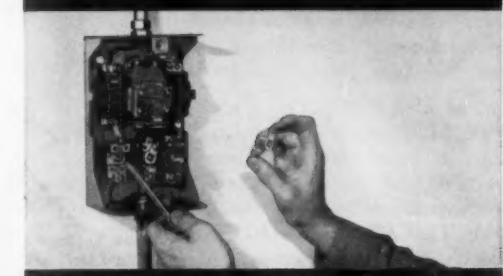
1 Loosen two cover screws and the wrap-around cover slides off exposing the entire starter mechanism. Captive cover screws stay in the cover . . . no time wasted searching for lost cover screws.



2 Remove the entire starter mechanism by loosening three screws. Then the enclosing case can be easily wall or machine mounted. Embossed mounts insure a firm installation even on irregular surfaces.



3 Once the case is mounted, conduit connections are easily made and wires can be drawn without any interference from the starter mechanism or case walls . . . no skinned knuckles or damaged starters.



4 Replace starter and wire. Wiring diagram gives complete directions, terminals clearly marked, and panel wiring color coded. Other plus features include straight-through wiring and front mounted adjustable overload heater coils.

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • Division: Airborne Instruments Laboratory. • Subsidiary: Cutler-Hammer International, C. A.
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

McGILL® PORTABLE LAMP GUARDS

are always a little better ...and all are UL inspected

- Rugged, steel wire cage. Spot-welded with extra heavy zinc plated, chromate finish.
- Tough, gray molded phenolic handle resists impact, heat oils, greases, some acids, moisture and abrasion.
- Concentrating end lens. • Convenience hook.
- Approved 3-wire grounded convenience outlet.
- Exclusive McGill LEVOLIER Switch. • Rotary reflector.

An extra margin of quality is designed and built into the complete line of McGill portable lamp guards for safe, dependable utility. Rugged, heavy duty construction and selected materials withstand the punishment of rough use. The famous McGill LEVOLIER switch mechanism provides a degree of dependability not found in ordinary portables. It's economical to specify the best.

More than 100 different types of McGill portable lamp guards have been developed to meet the particular requirements of a wide range of service conditions. Cages 50 to 200 watt, 660 watt, 250 volt sockets.

For detailed descriptions of the McGill line of top quality electrical specialties, including portable lamp guards, and Levolier switches write for McGill ELECTRICAL SPECIALTIES CATALOG No. 84.

No. 652 Lamp Guard

Rubber hook handle, thumb release clamp for easy bulb replacement. Can be hung, for maximum light, from hook or handle.

Write for Free McGill Catalog No. 84

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIV., 450 N. CAMPBELL ST., VALPARAISO, INDIANA

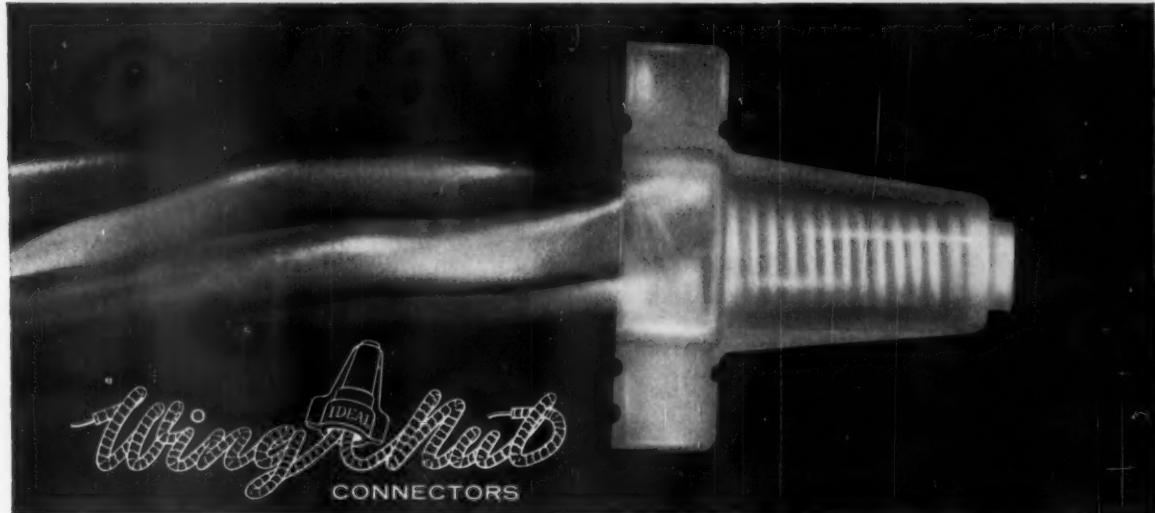
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JULY, 1959



engineered electrical products

McGILL®
precision needle roller bearings

NEW WIRE CONNECTOR



**At last -- a really easy way
to join heavy gauge, hard wires!**

BUILT-IN-WRENCH

New wings make it 50% easier to screw on, even on new stiff vinyl-insulated #6 wire. Wings eliminate wrenches; can be snipped off after applying.

"PYTHON GRIP"

New internal tension-spring coils adapt to shape and size of wires—apply tremendous pressure evenly over entire stripped area. Pressure is so great wires are threaded and crushed together.

NYLON SHELL

Insulating cap is Nylon... high dielectric, unbreakable and abrasion resistant. You can actually see your splice inside the semi-transparent Nylon shell. Compact—uses less space in junction box. U.L. approved for recessed fixture wiring because Nylon shell withstands 105° C.

New IDEAL "WING-NUT" Connector gives you the easiest yet most perfect mechanical connection possible. Wide skirt opening makes it easy to connect larger combination wires (example: two #8 with a #6) as well as the thickly insulated Type R wire.

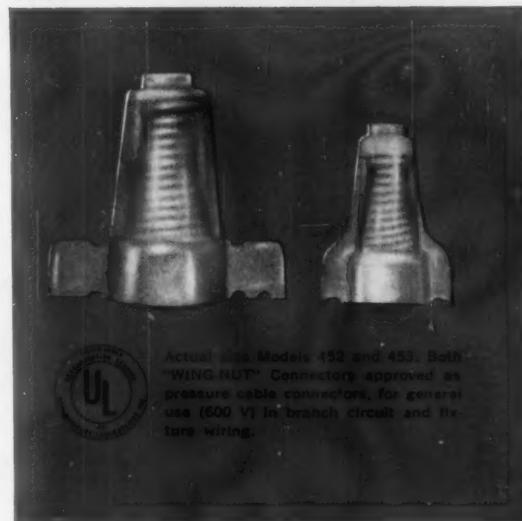
The new "WING-NUT" Connectors handle 474 possible combinations of solid or stranded wire... almost twice the number of other single piece Connectors. "WING-NUT" is available in two sizes.

Ask your electrical distributor about his special introductory offer.

SOLD THROUGH AMERICA'S
LEADING DISTRIBUTORS
IN CANADA:
IRVING SMITH, LTD., MONTREAL



ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JULY, 1959



MAIL THIS COUPON

IDEAL INDUSTRIES, INC.
1041-G Park Ave., Sycamore, Illinois



Yes, I want complete catalog data on the new "WING NUT"

Name. _____

Company. _____

Address. _____

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Here's the
inside story
of industry's

MOST RUGGED HIGH VOLTAGE SWITCH

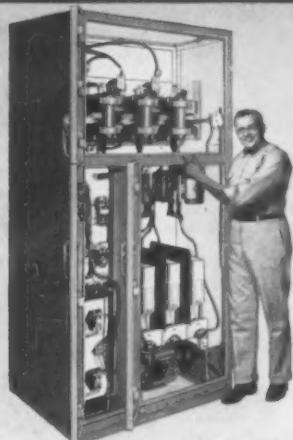
THIS SOLID-AIR BREAK
CONTACTOR IS THE HEART
OF THE A-B STARTER LINE

A tremendous operating life has been built into these new A-B high voltage, air break starters by using the same simple solenoid design—with only ONE moving part—that has proved good for millions of trouble free operations in Allen-Bradley low voltage starters.

A-B high voltage starters are made for all types of service and for all types of motors up to 1500 hp, 2300 v; 2500 hp, 4600 v. Send for Publication 6080, today.

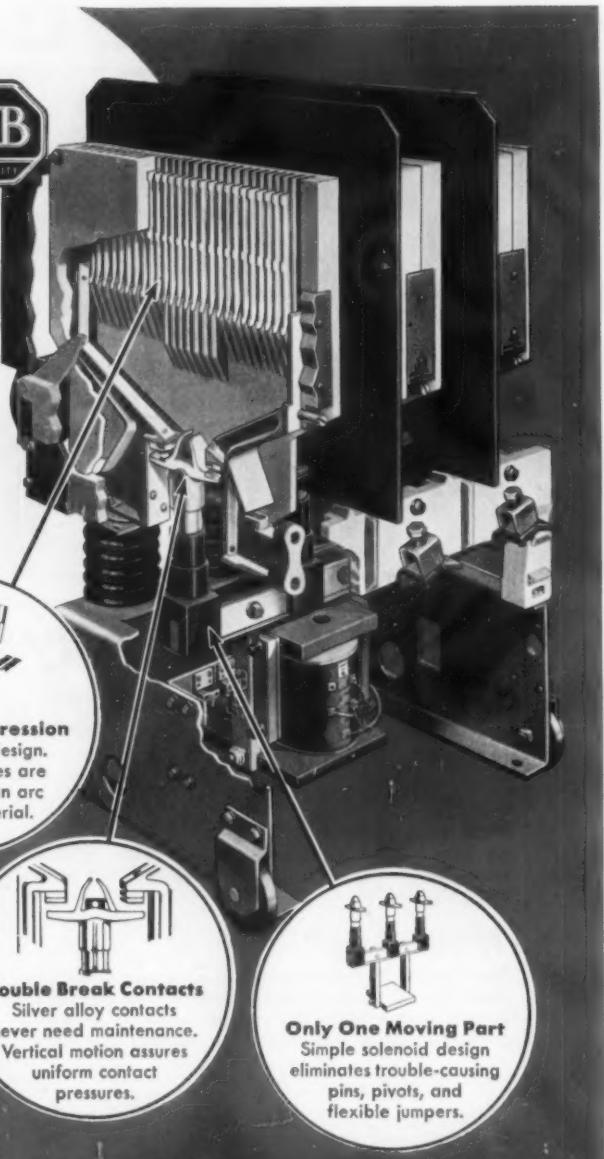
A-B High Voltage Starter with Air Break Contactor

Bulletin 1159 high voltage air break, across-the-line induction motor starter in NEMA Type 1 enclosure. All Allen-Bradley high voltage starters are equipped with current limiting fuses with interrupting capacities of 150,000 kva at 2300 v; 250,000 kva at 4600 v.



Allen-Bradley Co., 1307 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

48 ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JULY, 1959



ALLEN- BRADLEY

Member of NEMA
Quality Motor Control

Ocean-bed Bonanza!



Seven miles off the coast of Louisiana, Freeport Sulphur Company is preparing to tap a rich, new sulphur deposit — under 50 feet of water!

The base of mining operations, pictured above while under construction, consists of a Y-shaped island stretching for nearly one mile and towering more than 60 feet above the water.

Five large and ten smaller steel pile towers, connected by 200-foot-long bridge spans, support the complex facilities whereby sulphur is melted in its under-water formation by superheated water, and then brought to the surface in molten form.

The vital power for this operation pours from huge generators to the drilling platforms through Simplex submarine power cables. Simplex, a working partner of the mining industry for thirty years, is proud to participate in this monumental engineering achievement.

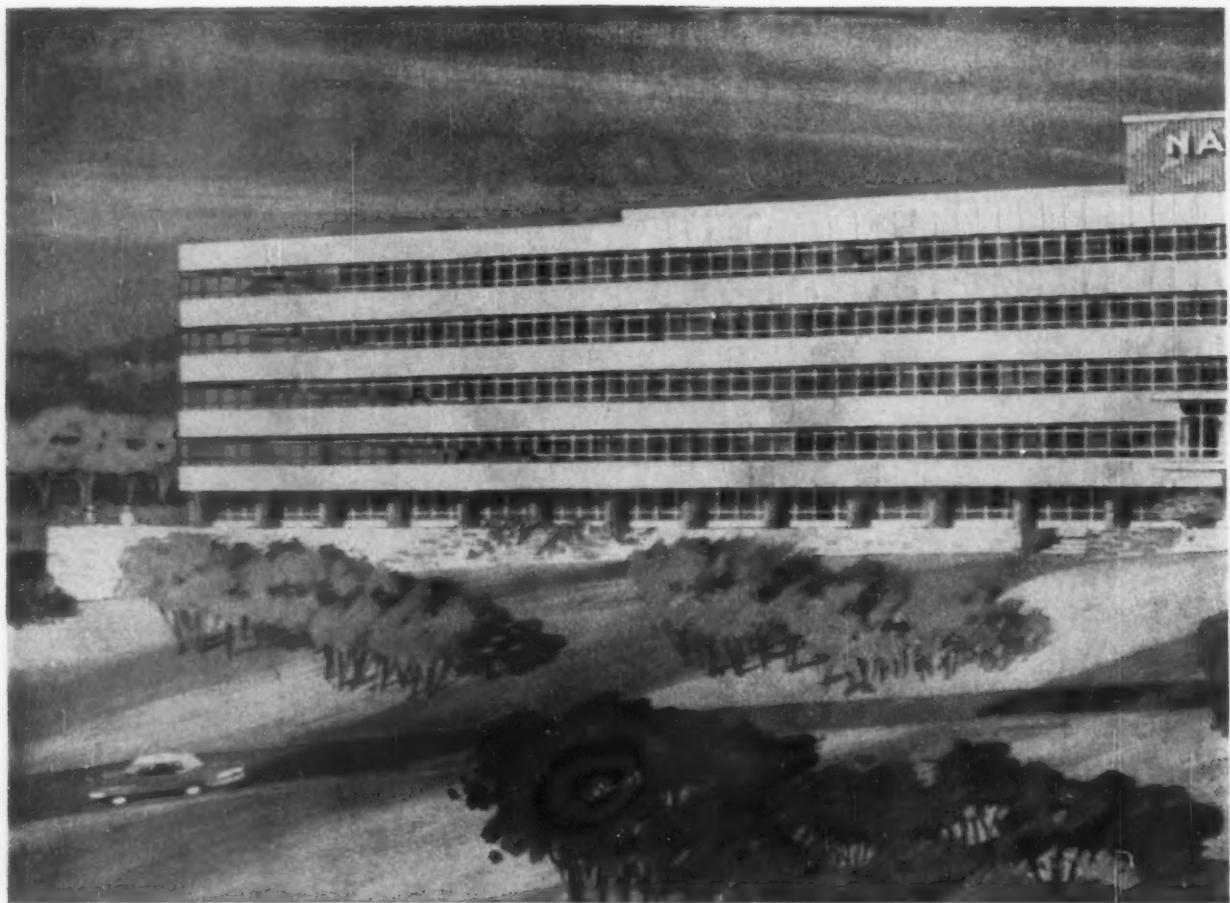


Simplex

WIRE & CABLE COMPANY

79 Sidney Street, Cambridge 39, Mass.





SPANG HEADERDUCT INSURES FLEXIBLE WIRING FOR NATIONAL LIFE



"This combination of SPANG HEADERDUCT and cellular flooring is the most progressive step in electrical wiring distribution in 25 years," states Mr. Santas. "Wiring is carried through the SPANG HEADERDUCT at right angles to floor cells, then runs as needed from the access boxes—one every 18 inches—through the floor cells to where the outlet is required."

National Life Insurance needed the most practical and up-to-date wiring system available for its new office building in Montpelier, Vermont. SPANG HEADERDUCT solved this problem by providing complete flexibility in the location of power, telephone and other communication outlets.

MOST PROGRESSIVE STEP IN 25 YEARS

Mr. Vern Santas, General Superintendent of the M. B. Foster Electrical Company of Boston, says: "The simplicity, flexibility and installation speed of SPANG HEADERDUCT for wire distribution in connection with cellular floor construction is the most progressive step in the electrical field in 25 years."

SPANG REPRESENTATIVE TRAINED CREW

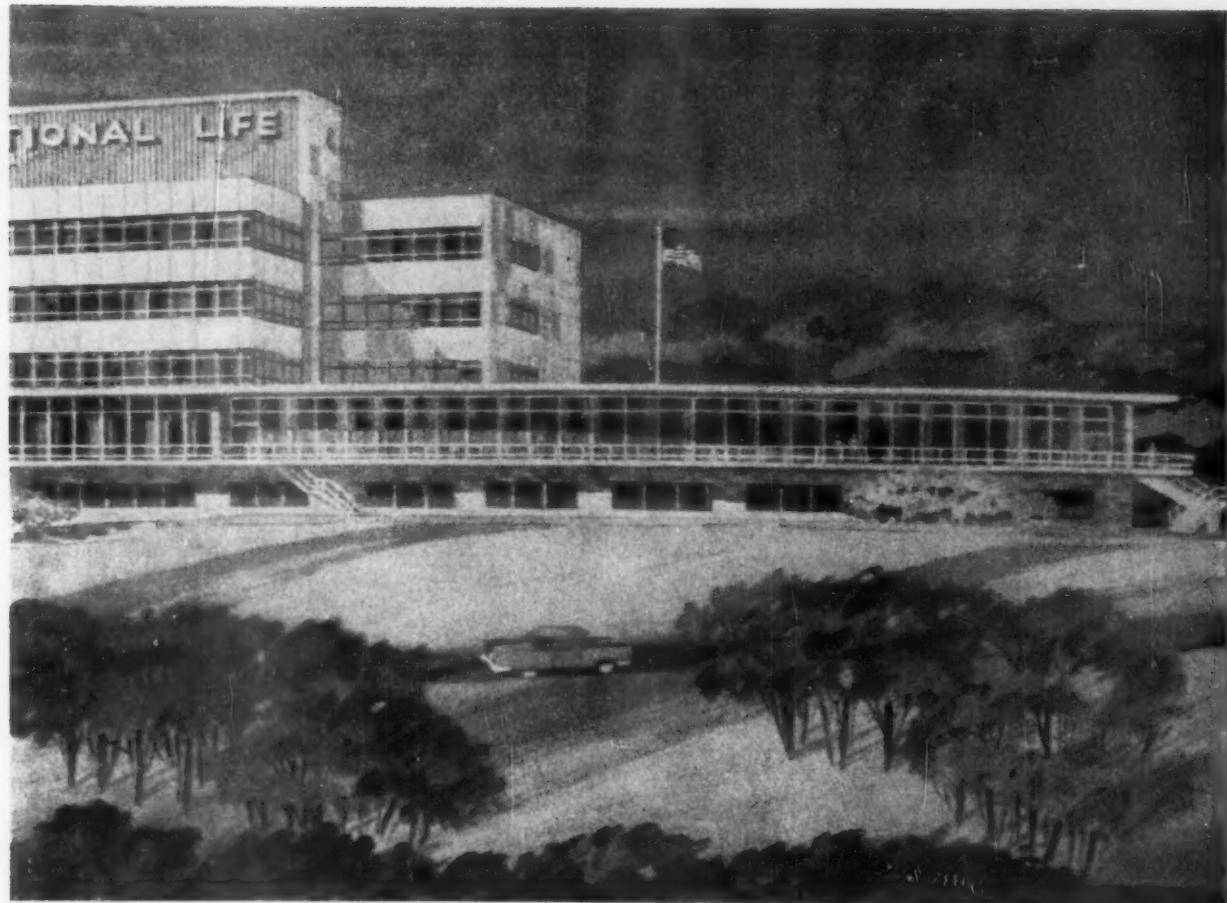
"This was our first SPANG HEADERDUCT installation," continues Mr. Santas, "so a SPANG representative trained my crew. We are now proficient in this type of installation and expect to use SPANG HEADERDUCT on new bids."

SPANG HEADERDUCT DESIGNED FOR FAST, EASY INSTALLATION

All component parts of SPANG HEADERDUCT are designed to eliminate as much fabrication time at the job site as possible. Coupling headerduct sections is fast. Corner leveling screws on access boxes bring boxes accurately to screed level without the use of a surveyor's transit. And square openings on access boxes give more working room for splicing wires and making future wiring changes after concrete is laid.

WRITE FOR MORE INFORMATION

See how easy it is to make a SPANG HEADERDUCT installation; write for your free copy of the booklet, *How to Install Spang Headerduct*.



Architect: Hoyle, Doran & Berry, Boston, Massachusetts
Electrical Engineer: Thompson Engineering Company, Inc., Boston, Massachusetts
Electrical Contractor: M. B. Foster Electrical Company, Boston, Massachusetts
SPANG Distributor: Wesco, Burlington, Vermont



Mr. Tewksbury and Mr. Morse, Foremen for M. B. Foster Electrical Company, discuss the ease of working inside square access boxes after concrete is laid. Square design provides more room for making splices. Access boxes are quickly brought to screed level by adjusting corner leveling screws.



Electrical crew installs SPANG HEADERDUCT at National Life job. Left to right: first man cuts through headerduct and into cellular floor with circular saw; next two men apply protective grommet around the opening with a hydraulic tool; workman on far right welds headerduct to flooring.



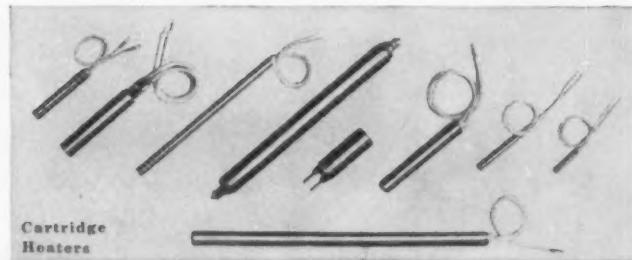
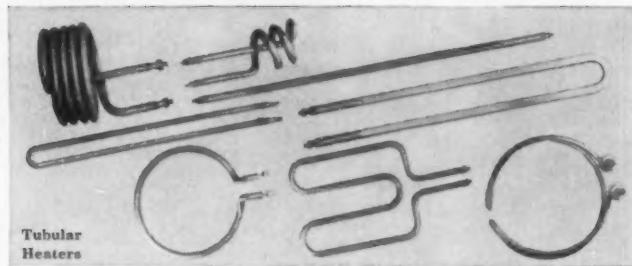
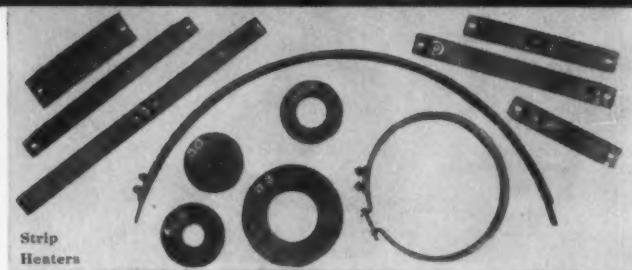
THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation



TWO GATEWAY CENTER, PITTSBURGH, PA.

Call your CHROMALOX Man for the heating answers



These 3 basic CHROMALOX heaters provide answers to just about any heating problem

Strip Heaters . . . that quickly and easily bolt or clamp to platens, dies, kettles, tanks, pipes, rolls, drums, ovens and air ducts. Lengths from 4 to 96 inches, widths from $\frac{1}{8}$ to $2\frac{1}{2}$ inches, with cross section curving or lengthwise bending. Available with brazed-on fins.

Tubular Heaters . . . that clamp on, fit into machined grooves, cast into metals, immerse in liquids, install in ovens and ducts. Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Available with brazed-on fins.

Cartridge Heaters . . . that smoothly fit standard drilled holes in dies, platens, molds, extrusion and injection barrels. Special leads available for protection against flexing action, abrasion, moisture or vapors. Diameters from $\frac{1}{8}$ to $1\frac{1}{4}$ inches, lengths from $1\frac{1}{2}$ to $25\frac{1}{2}$ inches.

Versatile Chromalox electric heaters are available in sheath materials and wattages to match almost any application to 1100°F . Easy to install, they are fast, clean, safe and economical.

Your Chromalox Man can help you determine the one that best answers your specific problem. He's backed by the world's largest factory stock of industrial heaters, ready for immediate shipment. Why not give him a call. You'll find his phone number listed at the right.

Our new Catalog 60 provides detailed product information and suggests numerous applications for the complete line of Chromalox electric heaters for industry. If you have not yet received a copy, please let us know.

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TRY-BEFORE-
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BLACKHAWK MFG. CO., Dept. H-2079, Milwaukee 46, Wis.

Ion-Balanced Air for home heating offers

- better health
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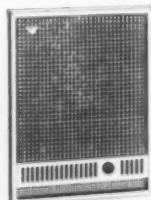
NEW WESIX-IONIX ELECTRIC HEATERS

When you select NEW electric heating by WESIX-IONIX you choose a selling feature for any house. For here, in a system that's easiest of all to install in new or older homes, WESIX offers exclusive ion-balanced, comfort conditioned living.

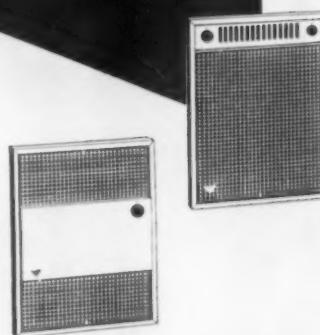
Now you can offer *easier breathing, better health and perfect comfort*. Now room air stays fresh without that winter-stuffy feeling. Now your homes stay clean and free from airborne bacteria, virus and pollens—because WESIX-IONIX destroys 90% of all airborne organisms.

And these new units are designed in styles, types and in price ranges to suit any building need. They're decorator designed and contractor engineered to bring a combination of customer-pleasing beauty and builder-pleasing ease of installation.

Be ready to profit from the growing demand for modern electric heating. Get all the facts on the most modern—Wesix-Ionix. Write for your complete catalog today.



WESIX ELECTRIC HEATER CO.
390 FIRST STREET • SAN FRANCISCO • CALIFORNIA



Knowing these simple facts puts you out in front

Negative Ions—tiny particles that can not be seen under even the most powerful of microscopes—have opened new frontiers in the science of comfort and health-conditioning of the air we breathe.

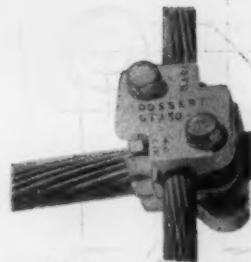
Science has learned that pure air contains a high proportion of negative ions—while stale city air is usually high in positive ions. This excess of positive ions makes breathing difficult and slows up the efficiency of the respiratory system, and can aggravate symptoms of asthma and hay-fever.

Wesix-Ionix research has found ways to reduce positive ions and make air "Ion-balanced" like outdoor air at its best. This feature is built into all Wesix-Ionix heaters and works with out noise or moving parts and without using any extra power to keep the air in any home PURE, FRESH and HEALTHFUL around the clock!



DOSSERT DESIGNED

with **YOU** in mind!



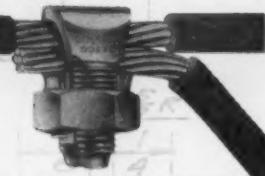
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(Type GTX)

For cross, parallel and tee tap connections.



LIGHT DUTY VARIABLE LUG
(Type G)

For economical, all-purpose cable connections.



SPLIT BOLT CONNECTOR
(Type DS)

For taps, dead-ends, entrances, motor leads, junction boxes, etc.



VARIABLE TERMINAL
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Connects a wide range of copper conductors to flat bar.



TWO BOLT SERVICE CONNECTOR
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Best for larger sizes.



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Takes various conductor sizes.
Quickly installed.

For **YOU**, the contractor...
For **YOU**, the wholesaler...

The products shown here are in constant demand
by contractors and are fast moving stock items.

All items accept a wide range of cables,
thereby, minimizing the number of stock sizes.

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for ease of handling and are attractively
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giving name of your distributor.



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Design and Workmanship
is second to none in Pylet cast metal conduit fittings. They cover every requirement from service entrance to power outlet in hazardous and non-hazardous locations.

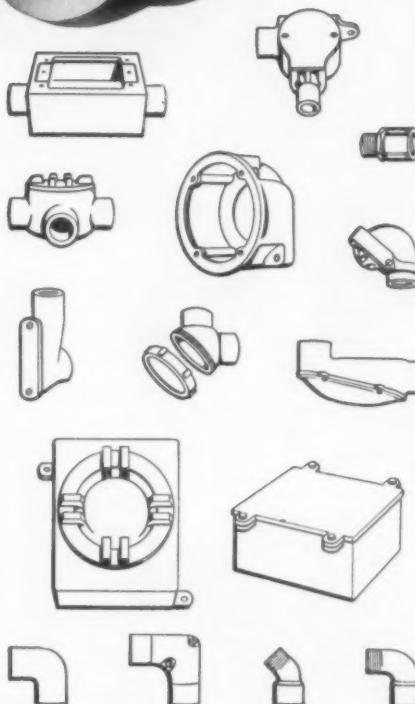
Taper threaded hubs tapped straight and true assure tight joints and perfect alignment of conduit and cover openings.

Cadmium plating of high lustre and thickness provides attractive appearance as well as unexcelled protection against corrosion.

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Specify Pylets for superior performance and long range economy.

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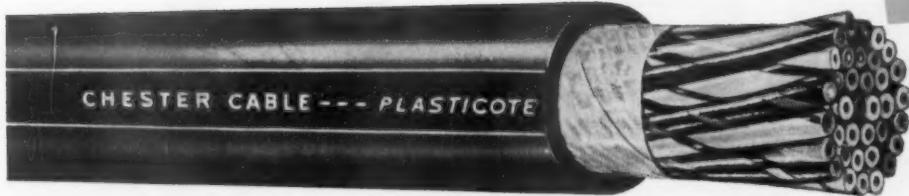
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CIRCUIT CONTROLS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • FLOODLIGHTS

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PLASTICOTE® INSULATED AND JACKETED CONTROL CABLE

Of all cable products, Control Cable has the greatest responsibility in safeguarding life and property . . . for on its unfailing function rests the immediate response to fire alarms, the constant operation of power station control circuits, the quick action of police and day-after-day traffic control. Chester's light weight, unusually pliable and highly resistant Plasticote insulated and jacketed Control Cable meets the strict Industry Standard specifications for all of these vital services. At the same time, Chester solves cost problems, too, with long life, trouble-free cable for direct earth burial, overhead and flexible lines in building installations. In many cases, physical and electrical properties exceed those of other types of insulation. Careful attention to all these needs, vital to service and installation, makes Chester Plasticote Control Cable a preferred brand for municipal services . . . for power station and supervisory circuits . . . for flexible or extension connections. Electrical men know that Chester cable is *custom engineered for the END result!*



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Specify Chester Wire and Cable For All Your Electrical Equipment Needs

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I-T-E CIRCUIT BREAKER COMPANY

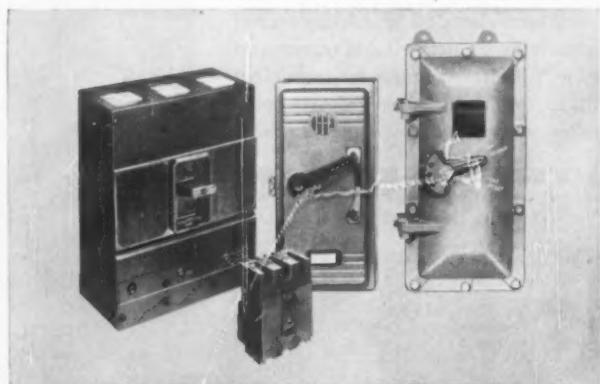
SAFETY

Yes, there's real economy in fused power switching centers, but make sure you also get the *extra safety* only I-T-E offers. In every I-T-E Power Switching Center, you have the assurance of knowing that switches can be closed *even into a fault* with complete safety for both personnel and equipment. Toggle-snap quick closing prevents burned contacts. In addition, Kirk key interlocks prohibit the opening of fuse compartment doors while switches are closed.

I-T-E Power Switching Centers are designed, of course, for both safety and economy. Unique I-T-E standard-

ized cubicles and building block construction reduce engineering expense (the saving is passed on to you), and also shorten the time between order and delivery. Equipment arrives on the job in sturdy, preassembled units, ready for easy, fast installation. And new feeders can be added any time.

These extra advantages add up to greater value... because you pay no more for I-T-E electrical equipment. That's why it is preferred among so many companies that insist on greater value. Investigate I-T-E equipment next time you buy.



First cost is your last cost. I-T-E molded case circuit breakers not only give you vastly better protection than fused devices... but in most cases they actually cost you less in the long run. To restore power after a fault, all you do is flip a toggle handle. Nothing to replace. No lost time. And you're absolutely certain that you have correct protection. Choose the circuit breakers you need from the I-T-E line... broadest in the field. Wide variety of enclosures for both indoor and outdoor installations.



Safety for conductors. I-T-E nonsegregated phase bus, safely enclosed in metal, shrugs off the hazards of dust and weather and provides complete protection for plant personnel. Widely used for connecting transformers to switchgear and for distributing power in factories. Far easier to tap into than cable. High dielectric strength. Available in a variety of types for indoor and outdoor installations. Ratings up to 13.8 kv and 3000 amp. I-T-E nonsegregated phase bus is delivered factory fabricated for easy installation and sure fit.



Individual circuit control. Install these new URELITE individually enclosed circuit breakers right near heavy loads or as local control devices for main trunk lines up to 600 volts. Main disconnect contacts visible through side window for extra safety. Now available with I-T-E K-LINE circuit breakers . . . world's most advanced. Pulldown handle action provides quick manual make for safety and long contact life. New, wide-range overcurrent trip device lets you increase breaker setting when the load increases. No parts to replace.

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Power switching centers Metal-clad switchgear (4.16 and 13.8 kv)
 Molded case circuit breakers Secondary unit substations
 Metal-enclosed bus TRANFO-UNITS
 URELITE circuit breakers CORDON® circuit breakers
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I-2

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information on I-T-E equipment.

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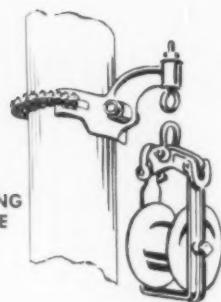
AERIAL
PLATFORM



CROSS ARM
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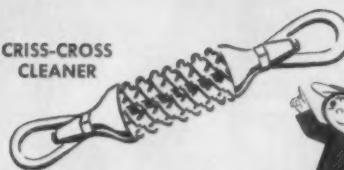


STRINGING
SHEAVE



IN CONDUIT AND DUCT

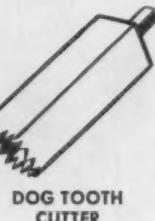
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ROD GRAPPLE



FLEXIBLE
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DOG TOOTH
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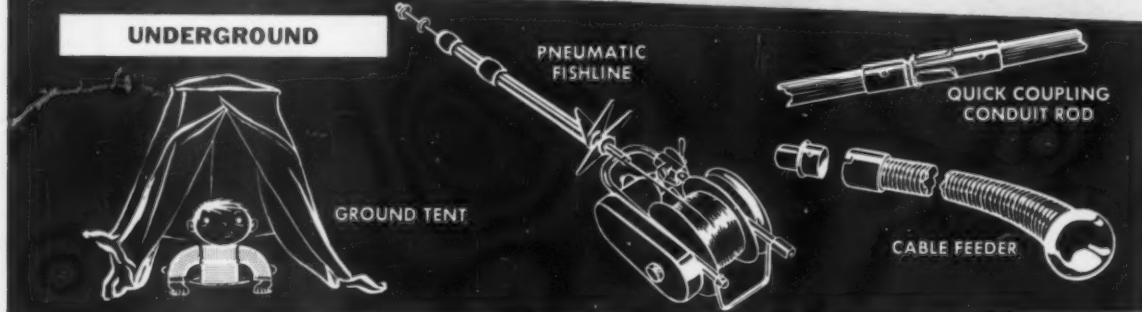
UNDERGROUND

PNEUMATIC
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QUICK COUPLING
CONDUIT ROD

CABLE FEEDER



COPE HAS THE EQUIPMENT TO SPEED THE JOB!

There's a Cope tool specifically designed for virtually every cable installation job! For example, Cope Pneumatic Fishline is a compact, air-operated device that enables you to fish underground duct in a matter of minutes. Cope quick coupling Conduit Rods, Rod Grapples and Pullers, Flexible Mandrels and Cable Feeders are designed to facilitate rodding and feeding of cable in a wide variety of conduit layout situations. Cope man-hole cover hooks, ladders and ground tents assure cost-saving efficiency on underground jobs.

For aerial cable installations, Cope Cross Arm

Sheaves, Stringing Sheaves and Angle Cross Arm Sheaves speed and simplify the toughest installation job. Each is available in a size to meet your particular cable requirements.

In addition Cope's Engineering Dept. is always available to assist you in the design or modification of these tools for specialized requirements. Cope Catalog 65 describes the complete line of Cope Cable Installation Equipment. Learn how you can save time and costs on every installation by having the right Cope tool on hand! **Call your authorized Cope Electrical Wholesaler for information.**

COPE

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since 1885

from MINE



to CIRCLE



to YOU



ONE SURE SOURCE OF SUPPLY for all your wire and cable needs

In wire and cable, contractors look for reliability of product, ample stocks, and friendly service. Working through a Circle distributor, you're assured of all three . . . and here's why.

Take *product reliability*. Quality control begins right with the basic metals mined and refined in Cerro's own facilities. Here skilled men make sure that every bar of copper, lead, or zinc is of the proper purity. This same attention to quality control is maintained throughout manufacture.

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FASHION PLATE, exciting new way to turn lights on . . . off. The only true decorator switch that's rugged enough for commercial and industrial use.

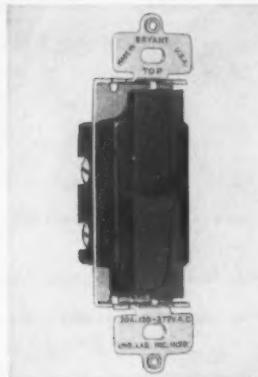
NEW TAP-ACTION FLUSH SWITCH FROM BRYANT

... FOR HOSPITALS, DEPARTMENT STORES, MOTELS, OFFICES, FACTORIES, HOTELS, RETAIL SHOPS, APARTMENT HOUSES . . . FOR EVERY COMMERCIAL OR INSTITUTIONAL JOB YOU WIRE

Tap-eez is the exciting new companion switch to Fashion Plate.* Its appearance is modern . . . the new, slim, tap-action bar blends well with design. More important, the attractive flush mounting makes it easy to clean . . . perfect for commercial applications where the

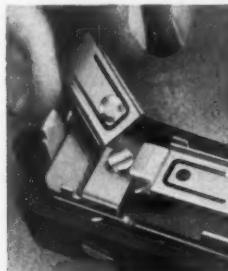
emphasis is on economic maintenance. Tap-eez has positive action, low maintenance and whisper quiet operation . . . no teasing . . . no arcing. Its service is more reliable than ordinary toggle switches . . . really built to last!

ASK YOUR BRYANT SALESMAN for a sample of Tap-eez. Take it apart and see the built-in quality . . . the trade-mark of Bryant superior wiring devices.



Smooth quiet action. Bar moves only $\frac{3}{32}$ " to operate mechanism.

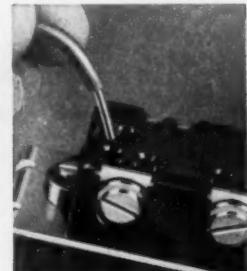
UNLIMITED APPLICATION—AVAILABLE IN SINGLE, DOUBLE AND TRIPLE GANG PLATES—IN BROWN, IVORY AND STAINLESS STEEL COMBINATIONS



Long-life silver alloy contacts. Positive controlled contact action. Rugged construction for heavy use.



Fits standard switch boxes, requires no special wiring. Compact design.



Easy, fast installation. Time-saving, clamp-type back wiring.

TAP·EEZ

*Trade-Mark

J-99017-R

The exciting things come from

BRYANT

THE BRYANT ELECTRIC COMPANY
BRIDGEPORT 2, CONNECTICUT



USS Tiger Brand Amerclad Cables are built tough and strong to withstand dragging over sharp rocks, and exposure to sun, rain, grease and oil.

Right—Strength and flexibility of Amerclad are shown by its use over this cable bridge leading to a power shovel.

Far right—Vibration resistance of the Amerclad Cable is the main reason for its use on this railroad track tamping machine.



Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical wire and cable?

Even though electrical cables may look alike and start with some of the same materials, there's a *real difference* in the completed cables.

The difference in USS Tiger Brand Amerclad Cables results from a combination of research, engineering and construction. The development of better materials goes on constantly at American Steel & Wire. Insulation and jacketing compounds have been improved.

Better stranding designs and methods of stranding add years to cable life.

Amerclad Cables are protected by an outer jacket of Amerprene, an oil resistant compound containing a high percentage of Neoprene. Before being vulcanized, an Amerclad Cable is encased in a substantial lead sheath that is afterward removed. The pressure developed within this rigid mold during the vulcanization process produces a dense, non-porous jacket that is highly resistant to abrasive wear.

Knowledge of severe field conditions obtained

through sales engineers permits designing for special conditions.

Constant effort to control quality and improved methods of inspection assure a product of highest quality.

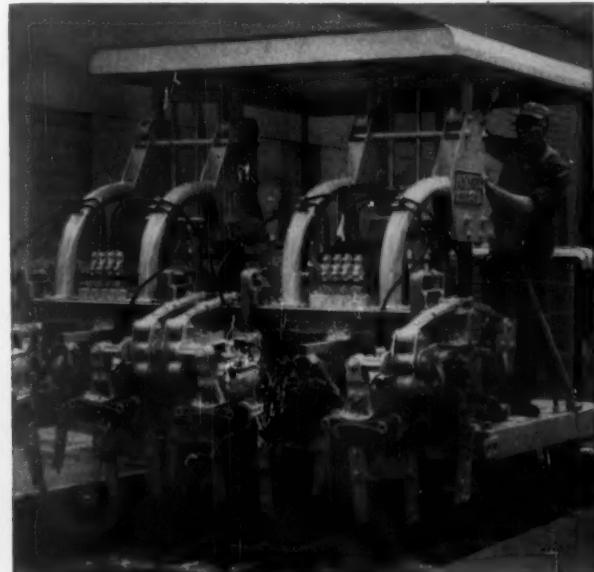
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New winding—A special winding scheme makes this extra smooth start possible. Special cross connections are made between coil groups of the basic motor winding. Result: balanced stator field on first step position . . . no cogging . . . smooth acceleration. Means that now motors will give better performance on part-winding start. Also, more time can be taken for acceleration because the winding does not go "across the line" until the rotor has reached a higher speed.

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with unloading valves. And with new Century Electric part-winding motors heavier loads than ever before can now be brought smoothly up to speed.

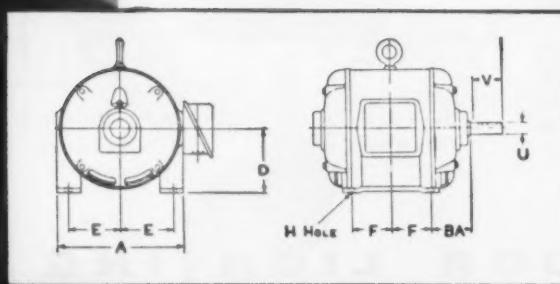
Construction—Century Electric part-winding start motors are available in approximate range of 20 to 150 hp sizes and in speeds of 1200 and 1800 rpm. They all have the high quality construction features of all Century Electric squirrel cage induction motors . . . coils are insulated with tough polyvinyl acetal resin . . . windings are dipped and baked with several coats of high temperature synthetic varnish which protect against oil fumes, mild acids and dust and grit . . . rotors are dynamically balanced so that motors run with extreme quietness and smoothness . . . rugged cast iron frame construction assures long life and low noise level.

Application aid—A Century Electric application engineer will be glad to discuss your part-winding start problems with you. Century Electric also makes a complete line of motors . . . all sizes and types from 1/20 to 400 hp. For a copy of the new Century Electric Motor Application Guide, please write for bulletin 270A.

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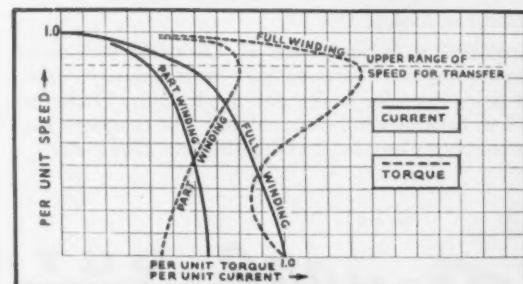
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Century
59-10



TYPICAL 30 HP part-winding start motor dimensions

Frame Size	Key	A	BA	D	E	F	H	U	V
SC 326U	1/2 x 1/2	16	5 1/4	8	6 1/4	6	2 1/32	1 1/8	5 1/8



SPEED-TORQUE curves show how transfer to full winding can be made at higher speed after current has fallen off.



Revere Outdoor Lighting makes driving and parking safe and easy at Eastpoint Shopping Center, Baltimore, Md. The well lighted parking lot makes the shopping center look more inviting. Architect:

Kenneth C. Miller; Consulting Mechanical Electrical Engineers: Whitman, Requardt & Associates; Electrical Contractor: Harry A. Goldberg Co.; Electric Wholesaler: Graybar Electric Co., Inc.

Revere's complete line of matched equipment makes any outdoor lighting job easier

Any outdoor lighting problem is easier to solve with Revere equipment. The wide line, from one source, lets you select the exact combination of fixtures required to do the job best . . . simplifies ordering and assures on-schedule delivery, too.

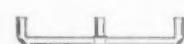
At Eastpoint Shopping Center (above), Revere Endoval Mercury Luminaires, mounted on Revere hinged poles, illuminate driving lanes. Parking area lighting is provided by Revere floodlights with 400-watt EH-1 mercury lamps. Floodlights are mounted two or three to a Revere hinged pole, with pole spacing 150 ft. Ballasts are in manholes between poles. Average maintained footcandles 1.1.

Installation of equipment at Eastpoint was easier because Revere components are *matched* for strength, balance, and perfect fit . . . and for peak lighting efficiency. Write for a Revere outdoor lighting equipment catalog. The complete, matched line makes solving any outdoor lighting problem easier.

Revere components used to light shopping center



No. 2222 Endoval Mercury Luminaires



No. 217-P Brackets



No. 199-J Brackets



No. 3351 Floodlights

No. 800 Series
(most arm not shown)
and No. 199-D-30
Hinged Poles

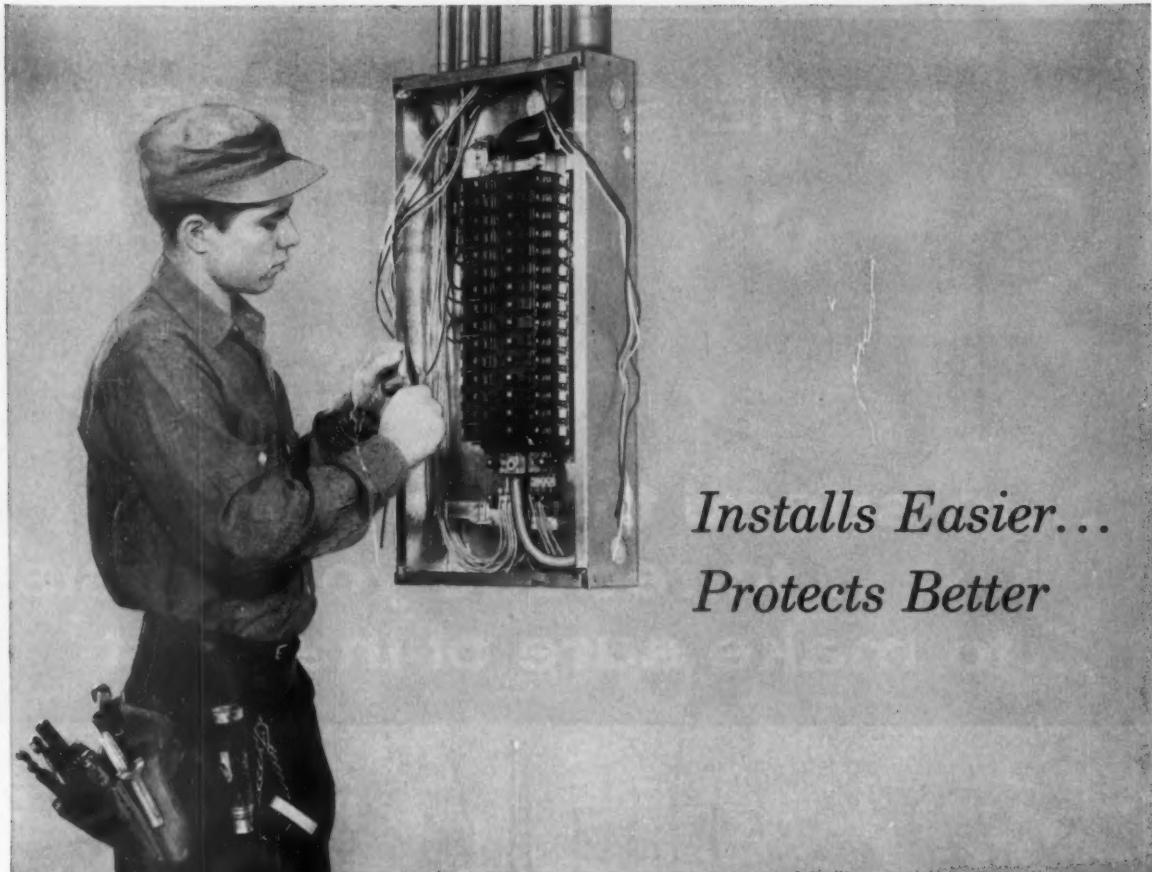


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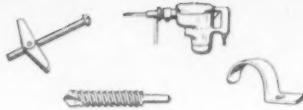
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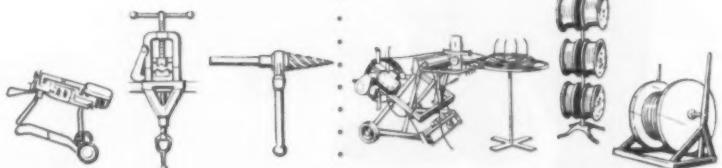
Materials Handling Equipment

Wire carts, hand trucks, conduit and wire storage.



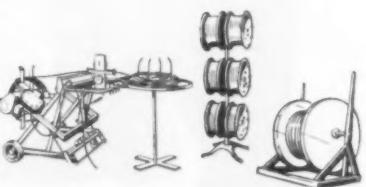
Mechanized Assembly Tools

Portable electric tools, punches, reamers, conduit benders.



Conduit and Raceway Tools

Pipe cutters and threaders, hydraulic conduit benders, portable band saws, reamers, wrenches, vises.



Cable Handling Tools

Reel trucks and carts, wire storage, wire measuring equipment, cable pullers.



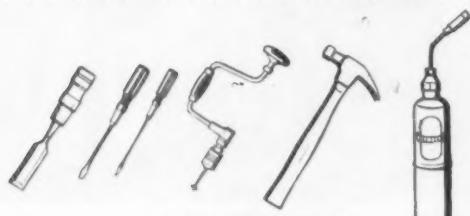
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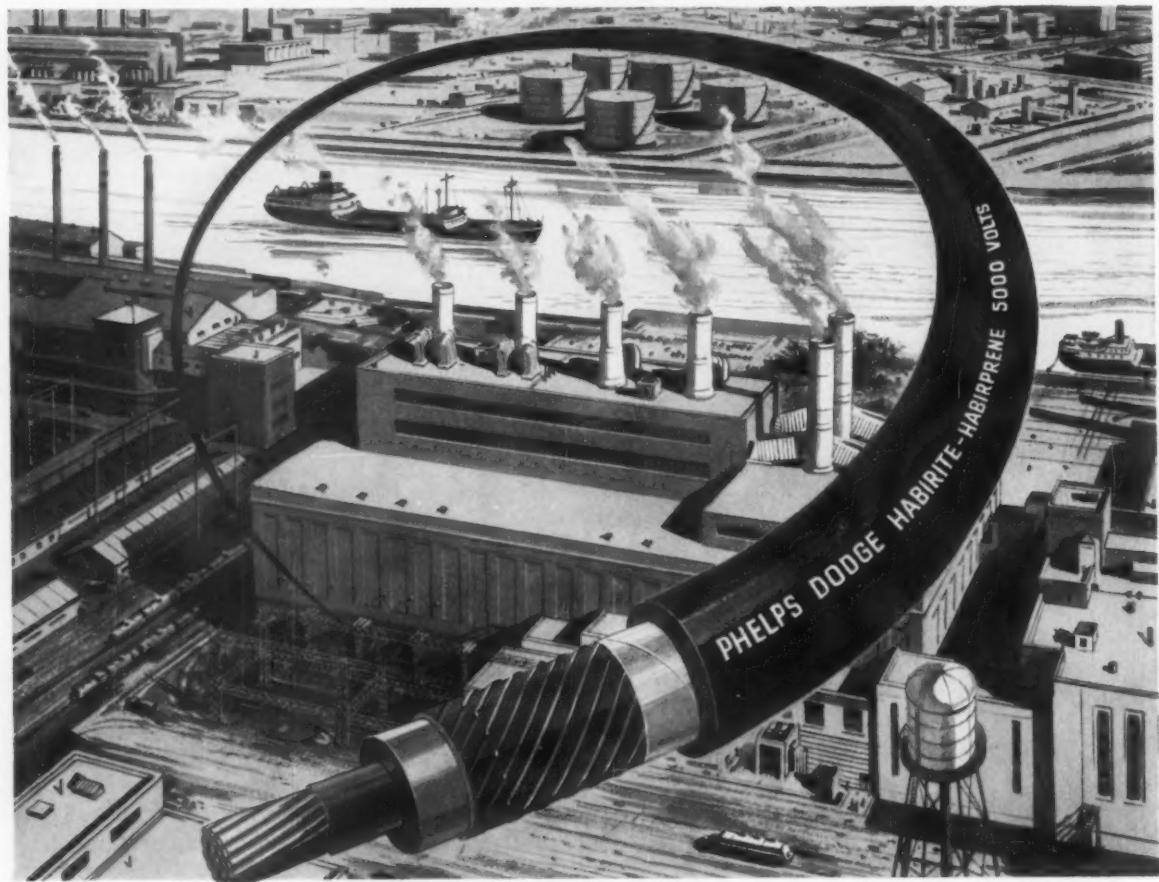
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- Better electrical properties that give a greater safety factor in operation.

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Let Contractors Carry the Peaks

Electrical contractors in several areas, notably Chicago, are engaged in a sales program to encourage industrial management to make a greater use of contractor services to supplement the work of plant electrical departments. There are sound business reasons why such services can be mutually beneficial. The development of more in-plant electrical work by electrical contractors is a logical target for promotional efforts.

Plant electrical departments have to be relatively lean, closely-scheduled organizations. For routine preventive maintenance, trouble-shooting and repairs, high efficiency can often be achieved with excellent cost control. In large plants, there may be also a sufficiently diversified load of small installations, moves, and alterations to occupy the full time of additional personnel. But larger system changes, installations and emergencies can present management with some tough problems.

Beefing up the department with temporary employees to accommodate peaks is not an easy solution and can be costly. Experienced electricians are scarce and likely to be regularly employed. The personnel office may have to take any warm body with usable training. The resulting load on management and supervisory personnel inevitably disrupts important established operations. And temporary employees tend to complicate the orderly administration of plant benefit and seniority programs.

Electrical contractors have expert electricians widely dispersed over many jobs of varying urgency. They handle extremes of manpower requirements on individual jobs as a matter of almost daily routine. They have the necessary tools, equipment, materials and supervision to run the job on any reasonable time schedule. And they are fully accustomed to working in close coordination and harmony with other crafts and with operating people in occupied areas.

Paradoxically, the most efficiently operated industrial electrical department is quite likely to be the least able to contend with substantial unscheduled work loads. The electrical contractor has a valuable service to render in helping to meet peak requirements with a minimum disruption of essential routines.

In farming out a part of the electrical work load, plant management is also acquiring a valuable asset at no cost. Electrical contractors prize good industrial accounts. They pamper them with their best attention and best personnel. A confident and close working arrangement between the electrical department and a good local electrical contractor—and a good local motor shop—places the full technical and manpower resources of these firms on constant stand-by, at no cost to the customer except for services actually rendered.

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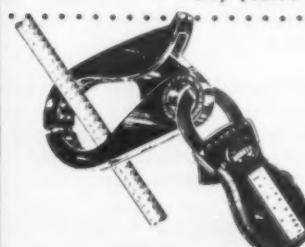
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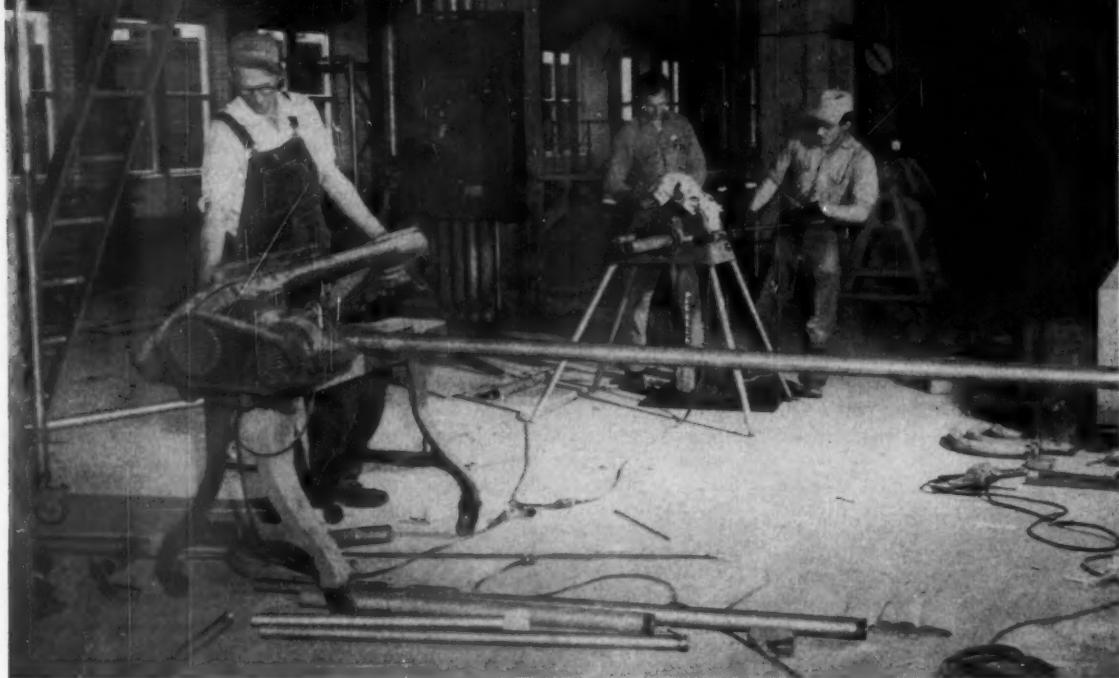
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**ELECTRICAL
CONSTRUCTION
AND MAINTENANCE**



MODERN POWER TOOLS are the key to economical installation of electrical system components. Typical of standard contractor practice is this field fabrication center, one of many on a multi-story construction project.

Cost-Cutting Job Mechanization

How modern tools and job methods can be applied to lower installation costs of today's electrical projects. A comprehensive review of current contractor techniques and cost-cutting practices adaptable to a wide variety of job conditions.

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COST-CUTTING JOB MECHANIZATION

COINCIDENT with the rapid advances during the past decade in the use of electrical energy for industrial production, operation of commercial enterprises, and modern living convenience, has been a parallel advance in the technology of electrical construction. Postwar experience has taught contractors the value of more and better job tooling; of more highly organized crews; of mechanized, production-line approach to highly repetitive operations. During those hectic construction years, electrical contractors were able to do more work than ever before with a fairly static skilled labor pool. Power tools and ingenious "methodology" developed by contractors were the apparent answers.

Today, with scheduled wage increases in the offing, the electrical construction industry faces a similar situation. Although apprentice training is in full swing, the net effect on an overall increase in the skilled labor pool may not be too significant. A four-year work and study program separates apprentices from Class A journeymen status. By the time they complete their training, the number of ap-

prentices may be slightly more than that required to cover normal skilled labor attrition (loss by retirement, death, etc.). At the same time, continued advances in the electrical industry bring more applications of electrical energy, more complex systems and controls, more need for installation and maintenance man-hours. The obvious answer is a "painless" increase in manpower productivity through the continued and improved use of power tools and equipment designed to simplify and facilitate installation practices.

All segments of the electrical industry are combining their efforts to achieve the common goal of increased productivity per man-hour expended plus an increase in the effective labor supply. Contractors are mechanizing and organizing their field operations to a much higher degree. Product design of electrical equipment manufacturers reflects a healthy consideration of installation and maintenance ease. Tool manufacturers are more conscious of the problems and needs of the "pipe" and "mechanical" trades and are producing an array of power tools and accessories

which find ready application in this field. Increased portability is reflected in design improvements incorporating lighter metals and added mobility features.

Progressive substitution of horsepower for muscle power throughout an installation effects substantial overall man-hour economies; extends the productive efficiency of older workers; preserves mechanics' physical reserve; redirects acquired skills and training to the more technical aspects of electrical construction. These advantages are showing up in current labor unit revisions and established job cost studies.

The quantity and variety of job-tooling requirements will vary with the amount and type of work a contractor normally does. No specific list will find general application. Each must be developed to fit an individual contractor's operation. Adequate job-tooling usually represents a substantial investment. This is not an overhead item. Tool charges should be allotted to each project as a direct job cost. These may vary from 3% to 6% of job payroll (based on field experience) depending on size and type of project. Tool charges are as much an installation cost as are the wages of mechanics on the job.

What tools and techniques can a contractor use to advantage? The following pages offer a fairly comprehensive report of mechanized field operations sectionalized into operational categories. Where available, relevant time-saving data is included. The tool check lists in each section are offered as a guide to establishing an adequate tool inventory or a handy reference for requisitioning purposes.

Interim tool purchases may be necessary to gain full advantage of power tooling on concurrent projects. Or specific tool items may be rented, with ultimate purchase in mind, for definite periods to offset abnormal peak demands. A number of such services are available to electrical contractors throughout the country. The best operating policy is, of course, to establish and maintain a permanent tool inventory to meet anticipated requirements. Development of a definite tool replacement program is considered good practice.

SAVINGS WITH MODERN TOOLS—1958 vs. 1938

(Comparison for a Specific Industrial Building Contract)

Division of Contract	Hours 1938	1958 Estimated Savings		
		Percent	Hours	Principal Factor in Savings
Lighting—Branch Wiring, Conduit and Boxes	425	15	64	Scaffolding
Lighting—Branch Wiring— Trim	96	5	5	
Lighting Fixtures	160	20	32	Scaffolding
Feeders—Conduit and Pull Boxes	150	20	30	Improved power pipe tools and scaffolding
Feeders—Cable Pulling	106	5	5	Improved pulling equipment
Panels and Cabinets	80	..	..
Connect to Present Switchboards	24	..	..
Power Branch Wiring	128	5	6	Improved power pipe tools
100 Amp Bus Duct	172	20	34	Hoists and scaffolding
Miscellaneous	48	..	..
	1,389		176	

Approximate Saving in Man Hours—12.7%

Notes: Conditions—steel construction building; 14-ft ceiling height, clear floor area.
Source: Ray Ashley, Electrical Engineering and Estimating Consultant, Oak Park, Ill.



TOOL CHECK LIST

- Bins, materials and parts storage—metal, wood
- Blocks, snatch
- Block and tackle
- Boxes, storage, stationary, rolling—wood, metal
- Chains
- Conveyor sections, roller, wheel
- Cribs, parts and accessories stock—metal, wood
- Cranes, chain, floor, overhead—manual, power driven
- Dollies and carts, small, large
- Hoists, chain, manual and power driven
- Jacks, screw, reel, gang, payout—manual, hydraulic
- Lift platforms—hand, motor, or hydraulic operated
- Reel rollers
- Rope, hemp, wire
- Slings, rope—hemp or steel
- Tongs, chain
- Trailers, highway type for tool and material storage
- Trucks, wagon, industrial, fork lift

COST-CUTTING JOB MECHANIZATION

MATERIAL HANDLING

BEFORE a foot of electrical material, or a pound of equipment can be installed, it must be delivered to the job-site, stored, distributed to fabrication centers and points of installation. If permitted, this phase of electrical construction could absorb a good part of the total labor cost for the project. Adaptation of modern material handling methods to electrical construction work has, over the years, reduced this from an estimated 25% (pre-mechanization era) to about 5% or less in current experience. Now, wheels are replacing workers' sturdy legs, and motive power replaces the strong back and biceps of the mechanic.

Material handling begins in the contractor's shop. Tools, conduit, fittings, cable, ladders, scaffolds, etc., must be loaded on trucks for

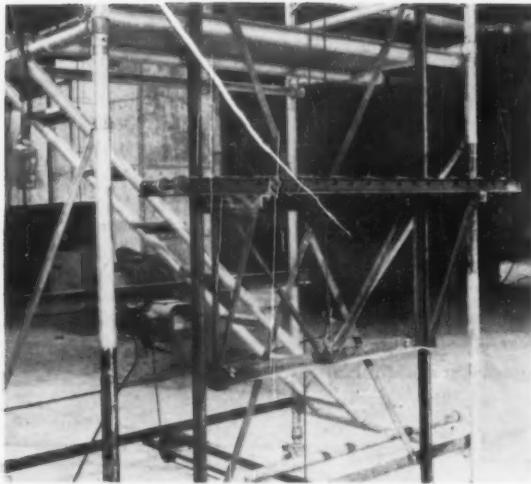
transportation to the job. Some shops have hydraulic platforms to raise material to truck height. More contractors are equipping their trucks with hydraulic tail gates which operate as elevator platforms to raise and lower material. A number of the larger firms have one or more fork lift trucks for shop and field use.

A new concept of material and tool delivery and storage at the job site is rapidly gaining favor with electrical contractors. This is the use of large highway semi-trailers which combine field office, warehouse and workshop in a single unit. Loaded and locked at the shop, they can be delivered to the job by common carrier, or contractor's own tractor. At the site, they replace the conventional "job shanty" (require no assembly and disas-

sembly); prove less vulnerable to theft; are ready to roll again at a moment's notice. Field reports from users indicate they are exceptionally convenient, economical, and provide an effective advertising medium. Many contractors own several units, rent additional trailers when work loads and storage problems warrant.

Application of mechanized techniques to movement and dispersal of material and equipment at the job-site has resulted in a substantial slash in material handling man-hours. Among the time-saving methods observed at various electrical construction projects throughout the country were the following:

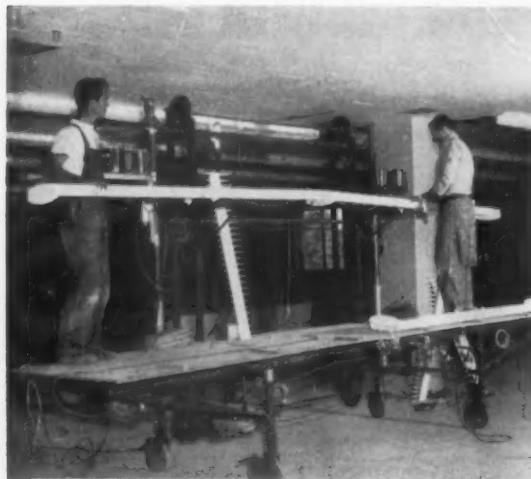
Switchboard sections and cubicles moved and set by fork-lift truck.



ELEVATING PLATFORM mounted to side of rolling scaffold raises and holds bus duct section while mechanic makes connections. Pushbutton controlled motorized platform is section of wheel conveyor to simplify duct positioning; has special V-end plates with roller bearing saddles for conduit work.



LIFT TRUCK raises material and personnel to speed bus duct installation. On this job, a 3-man crew was able to do the work of a former 5-man crew (rearranging scaffolding) in approximately one-third less time. Platform is replaced by other accessories to do other construction chores.



MOTORIZED FIXTURE LIFT incorporated in rolling assembly bench and scaffold permits two men to install 16-ft fluorescent fixture section in commercial building project.

Large quantities of fluorescent fixtures stacked and delivered to job on wood pallets. Contractor's fork-lift truck unloaded pallets from semi-trailer and spotted fixtures at installation points. By pre-arrangement with manufacturer, fixtures were delivered without conventional cardboard cartons—eliminated factory packaging and job unpacking. Palleted "stacks" of metal under-

floor duct spotted by a crane at various floor levels of a multi-story building.

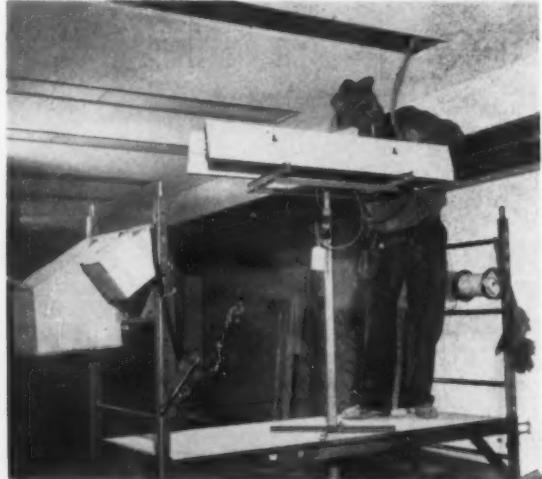
Motorized side platform attached to rolling scaffolds to raise bus duct and conduit into position for attachment to pre-installed hangers.

Mechanical and motorized "lift" attachments to mobile scaffolds and work tables to raise and hold assembled lighting fixtures in posi-

tion for final circuit attachment.

More extensive use of a representative group of hand trucks and dollies to move materials from distribution and pre-fabrication stations to installation areas. While distance, bulk and weight are controlling factors, this concept was also successfully applied to smaller items and smaller jobs.

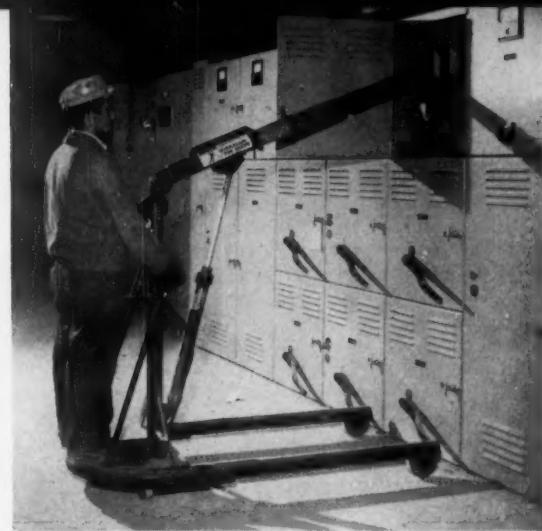
An increasingly broader use of



SIMPLE LIFT with spring-operated mechanism holds troffer section for circuit connection, raises and positions it in ceiling cavity while mechanic anchors it.



INTERIOR of trailers are outfitted functionally. Here slotted-angle racks and shelves hold duct, conduit and wiring accessories. Some units have complete electrical facilities.



SMALL PORTABLE hydraulic crane proves an effective time-saver on many operations inherent to electrical construction work. One man can move and operate this $\frac{1}{2}$ -ton unit.



REVOLVING CLAMP attachment on lift truck picks cable reels off floor and nests them on shelves of rack installed to conserve storage space.



MOBILE RACK transports pre-bent conduit lengths from centralized fabrication area to points of installation. Here, two mechanics move up to 75 lengths in one trip.



SMALLER TRAILERS provide same function as large units; can be hitched to light pick-up truck. Sometimes a number of smaller trailers work out better than a large unit.



HAND CARTS facilitate movement of heavy bus duct sections from central storage area to points of installation in a commercial building project.



HYDRAULIC TAIL GATE loads truck in a jiffy in contractor's yard; simplifies unloading at job site. Elevating tail board eliminates back-straining lifting of heavy and bulky items.

PALLETED STACKS of metal underfloor duct are unloaded from trailer truck by crane and spotted at required floor levels of new office structure for convenient dispersal in installation areas.



MOBILE BIN LOCKERS spotted on various floors of a multi-story construction project keep electrical crews supplied with necessary wiring materials.

DOLLY CABINET with conventional hand-truck base can go through standard doorways; keeps within easy reach of electricians a supply of the many small items and tools needed on the job. Door and metal drawers can be padlocked.



mobile parts and accessory bins and cabinets for convenient storage and dispersal of the host of small items such as outlet boxes, conduit fittings, fastening devices and similar supplies. These have proved effective on both large area and multi-story construction projects. The ultimate goal is to reduce mechanics' backtracking to a minimum.

Where applicable, use of roller and wheel conveyor sections to position materials and equipment.

The type and quantity of time-saving material handling equip-

ment on a given project will vary with the type, size and layout of the building and the structural conditions encountered therein. Much depends upon the ingenuity and field experience of contractor personnel constantly alert to mechanization opportunities. Those who take full advantage of modern methods at this initial stage of a project invariably extend their labor-saving research to other installation categories. The net result is a progressive refinement of techniques and methods that benefit all concerned.

HANDLING BUS DUCT

PLUG-IN TYPE BUS DUCT—HOURS PER FOOT

(3-Phase, 4-Wire)

INSTALLATION TIME

AMP SIZE	WEIGHT/10-FT (LBS)	MANUAL	FORK LIFT TRUCK
225	85	0.330	0.330
400	130	0.375	0.375
600	150	0.390	0.390
800	220	0.675	0.450
1000	250	0.780	0.520

FEEDER TYPE BUS DUCT—HOURS PER FOOT

(3-Phase, 4-Wire)

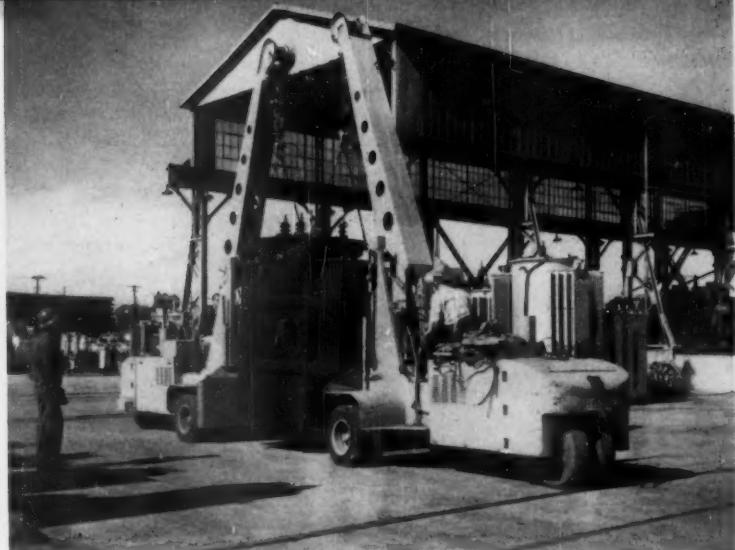
800	195	0.690	0.690
1000	235	0.825	0.825
1350	275	1.260	1.000
1600	325	1.440	1.100
2000	365	1.600	1.300
2500	445	2.400	1.600
3000	525	2.775	1.850

NOTES: Fastenings and hangers not included. Either 250 or 575 volts. Deduct 10% for 3-phase duct.

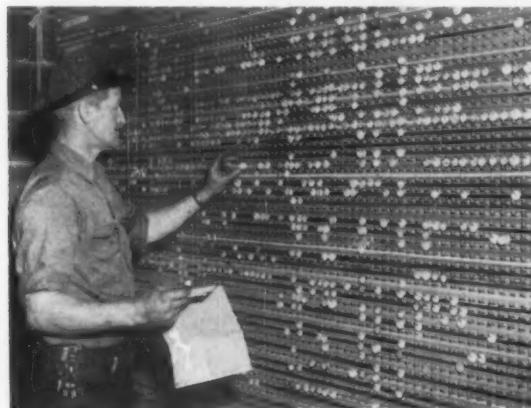
Source: Electrical Construction Cost Manual—McGraw-Hill Book Company, 1958.



READY TO ROLL is this hydraulic bender packed in its original crate. Case was transformed into handy mobile storage unit by adding wheels, hinged cover, hasp and padlock.



TWO MOBILE cranes in synchronized operation move a bulky 15,600-lb transformer; offer precise handling facilities for heavy equipment.



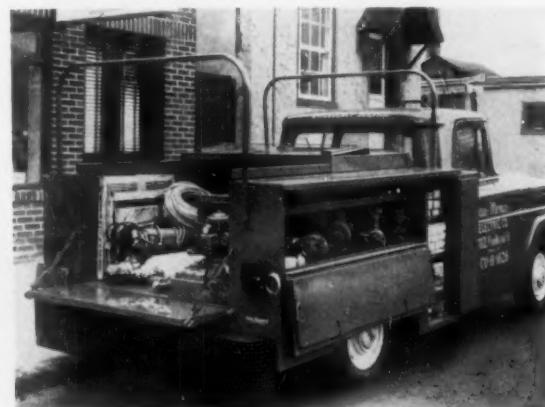
JOB TOOLING importance is evidenced by this contractor's shop tool control board. The 65 horizontal rows (projects) are crossed by 84 vertical columns (tool categories). As tool items are dispatched, tag is placed on proper hook.



RUGGED METAL tool and material boxes on industrial casters are standard equipment with one contractor. Tapered access opening with drop-leaf lid speeds loading and unloading shelf, pull-out tray, and deep material well at base.



LARGE SEMI-TRAILERS provide a permanent "portable stock room and work shop" with maximum mobility at job site; take comparatively little space; give a "plus" advertising value to contractors.



JOB-PLANNED trucks are available to fit almost any contractor need. This emergency service unit provides covered body well, ladder supports and convenient side lockers for tools and material.



TOOL CHECK LIST

- Beam buggies, overhead type, monorail suspension type—to work above or below roof steel before or after roof is in place.
- Elevating platforms, electric, hydraulic, hand operated—for one or more mechanics.
- Ladders, step, A, rigid, extension—wood, metal.
- Platforms, single, extension—painter's type, wood or metal, to bridge ladders or scaffolds.
- Scaffolds, adjustable, rigid, rolling, stationary, sectional, telescopic.
- Towers, rolling, hydraulic lift type with platform.
- Trucks, fork lift, platform boom, telescopic boom, telescopic ladder.

COST-CUTTING JOB MECHANIZATION

SCAFFOLDING AND PLATFORMS

WHILE the present trend is toward more extensive ground-level pre-assembly of electrical system components, mechanics are still needed in elevated positions to fasten these sections to pre-installed supports. This means that

some type of scaffolding or elevating platform is needed on practically every electrical construction project. The type and size of the facility used depends upon the work involved and structural conditions encountered. Equipment selected

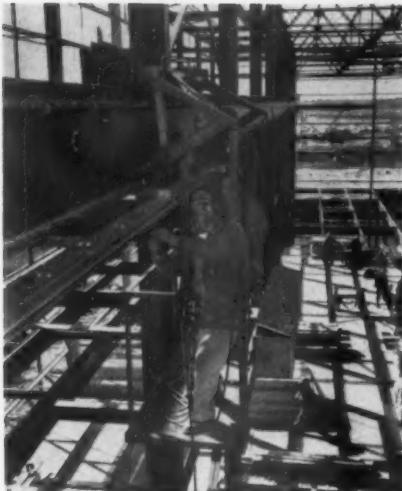
may range from the basic step ladder to the highly mechanized telescopic boom platforms rapidly gaining acceptance in the electrical field.

Personnel safety is a prime consideration and reliance on a makeshift scaffolding system is a hazardous, expensive and highly questionable practice. Unless mechanics working in high areas have confidence in their footing, man-hours will climb, workmanship will suffer and anticipated savings from the use of power tooling may be nullified. That's why modern ladders and scaffolding are an important part of every electrical contractor's tool and equipment inventory.

Most often seen on field projects are sectionalized scaffolding systems whose basic designs reflect careful consideration of electrical contractor needs. They are strong and light weight for portability ease; they can be erected and dismantled in a matter of minutes; additional sections can be added easily to attain prescribed height; they have locking swivel casters that facilitate job mobility, yet contribute to stationary rigidity. Some have "inside" stairways for climbing ease. All have helped the contractor effect substantial reductions in



TELESCOPING BOOM platform truck is a versatile piece of contractor equipment. Platform remote control permits operator to lower or raise boom from ground level to 40-ft height, swing back and forth through full circle. Boom doubles as hoist when platform is removed.



MONORAIL PLATFORM rides suspended over side of crane-rail beam; carries 3-man crew installing trolley duct run in high-bay area; has attached tool and parts chest on side.



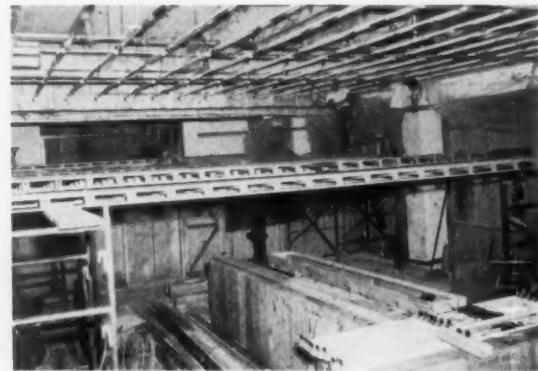
LIFT TRUCK with platform attachment simplifies overhead transformer connections after circuits are installed.



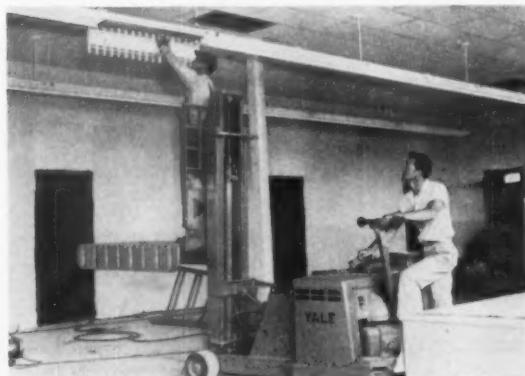
THREE-SECTION light-weight aluminum rolling scaffold has "inside stairway" for climbing ease; brings electricians within convenient working distance of this gymnasium ceiling.



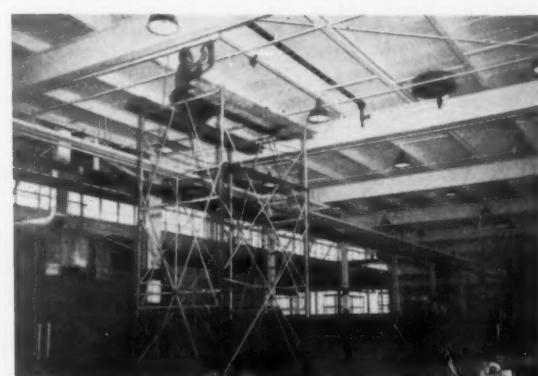
HIGH LEVEL work platform bridges two rolling scaffold towers; incorporates inclined equipment lift to feed duct and fixtures to installing mechanics.



ALUMINUM SCAFFOLD PLANKS rest on four rolling scaffold sections; span building bay to provide large area work mezzanine for mechanics installing luminous ceiling system.



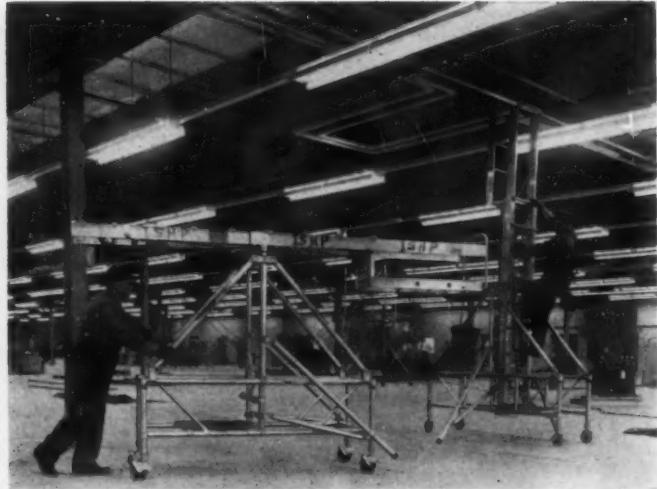
ONE DAY was cut from normal fixture installation time in a 50-ft by 1201-ft office by contractor's use of two lift-trucks as shown.



LARGE AREA elevating platform incorporated in this rolling scaffold is operated by hand winch at base. Unit can be lowered to clear ceiling obstructions when moving.



ELEVATING PLATFORM rig is narrow enough to pass between machines; has telescoping sections to raise mechanic to work level; is operated by winch near base. Wheels provide mobility.



TELESCOPING ALUMINUM ladder with enclosed work platform extends to 30 ft; folds down in retracted position for passage through doors. Rolling base is 29 ins. wide and has swing-out outriggers to stabilize extended unit. On one 3600-fluorescent-fixture installation, a contractor reported a 25% labor saving by using this type of unit.

high-bay man-hour requirements; have, in effect, raised the ceiling on economical high-bay installation practice.

Field experience proves that adaptation of scaffolding systems to specific installation conditions and problems is limited only by the inherent ingenuity of the user. As noted in the preceding section, one contractor added a motorized lift to the side of a rolling scaffold to raise and position material for the installation mechanic on the platform. Another firm bridged two rolling scaffold towers with a sturdy work platform and incorporated an inclined motorized lift to feed busway and fixtures to the topside mechanics. Where required, effective work mezzanines can be built by bridging scaffold towers to provide wide area work platforms for groups of mechanics. In some instances, scaffold sections have been converted into rolling workshops with a lower platform crew fabricating material to be installed by workmen on the upper level.

Beam buggies have been used to advantage by some contractors on new flat-roof industrial projects. Alert field engineers designed a four-wheel rig (flanged wheels) to ride the top of parallel roof beams before roof installation. Electricians propelled themselves along in the rig, leaned down between guard rails and fastened suspension clamps and rods to the underside of

the beams. On another project, monorail platforms, suspended from the underside of a beam, were successfully used to install electrical facilities without the need for high-bay scaffolding.

Scaffolding is most efficient where a substantial work platform is needed and where the floor area is level and clear. Even high-clearance units cannot be used effectively in some congested areas where installed machinery and limited traffic aisles are a problem. Under such conditions, telescoping platform units work well. They may be hand, electrically or hydraulically operated. Fork lift trucks with service platforms, platform boom trucks and variations of this type of equipment are finding extensive application to electrical installation and maintenance operations.

For installation and maintenance work above the 30-ft level, a relatively new series of hydraulically

operated, jack-knife boom platform trucks are being used by electrical contractors. Depending upon size, these units can extend to 40-, 60- and even 95-ft heights, swivel 360 degrees or more. Generally, the mechanic on the platform can fully control boom operation by a system of remote control switches. Although basically used for outdoor lighting maintenance, these units are being effectively adapted to indoor construction and maintenance projects in unusually high areas.

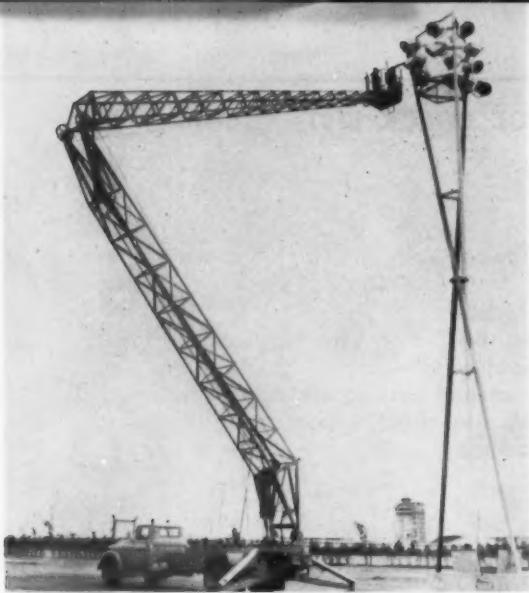
Standard estimating practice has been to add approximately 5% per foot for every foot above a 12-ft working height to labor units for specific installation categories. As indicated in the accompanying table, extensive use of scaffolding can reduce this somewhat. Chances are that field experience with the newer boom towers will show substantial savings on exceptionally high-level work.

ADDITIONS TO MAN-HOURS FOR WORKING HEIGHTS

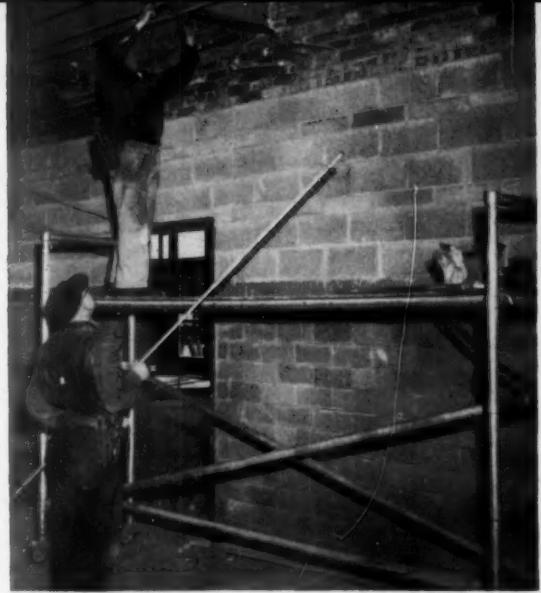
(Percent Added to Affected Man Hours)

WORKING HEIGHT	USING LADDERS	USING SCAFFOLDS
14 ft to 18 ft.....	10% to 30%	10%
18 ft to 20 ft.....	30% to 45%	10% to 30%
20 ft to 28 ft.....	85%	30%
28 ft to 30 ft.....	.....	30% to 45%
30 ft to 36 ft.....	.....	45%

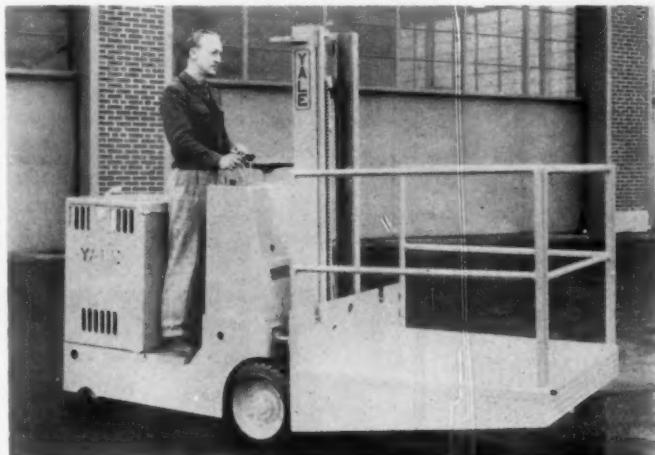
Source: Electrical Construction Cost Manual—McGraw-Hill Book Company, 1958



95-FT HEIGHTS can be reached with this hydraulically operated aerial tower designed for interior and exterior high-level installation and maintenance. Mechanics on platform can control tower operation; have communication with truck.



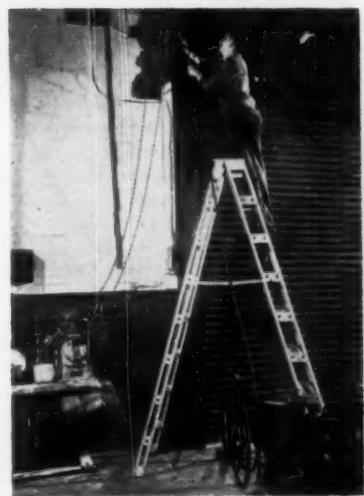
NARROW, LIGHT-WEIGHT rolling scaffold section permits 2-man installation team to work efficiently in corridors, through narrow doors and openings. Ground man fabricates material and moves scaffold.



SERVICE PLATFORMS with detachable side guard-rails (for loading and unloading) and 16-sq-ft floor area are now available for quick attachment to the fork carriage of a lift truck.



ROLLING TOWER follows bus duct run; simplifies attachment of bus-plugs for power takeoff. One man can move tower from position to position.



STEP LADDERS are still an electrician's basic "tool" for working at moderate heights. Light weight and portability of aluminum units like this are a definite advantage to contractors and maintenance crews.



TOOL CHECK LIST

- Anchor sets—masonry, etc.
- Braces, ratchet
- Burners, acetylene, gas
- Clamps, C, beam, pipe, tap-on
- Cords, electric extension
- Crimping tools, manual, hydraulic
- Drills, wood, masonry, steel, twist, star, core, tall reach, Carboloy tipped, diamond core.
- Drills, manual—separate, integral part of anchoring device
- Drills, electric—high speed, slow speed, impact type
- Drivers, stud—powder actuated
- Drivers, concrete nail
- Electric welders, stud, spot
- Framing, continuous channel, slotted angle
- Goggles, safety
- Gloves, safety
- Hammers, manual, electric, pneumatic
- Inserts, concrete
- Nut runners, electric, pneumatic
- Screw drivers, hand, ratchet, drill attachment
- Screws and bolts, assortment
- Stocks, bolt, angle, channel
- Taps and tap wrenches
- Torches
- Welding equipment, electric acetylene

**COST-CUTTING
JOB
MECHANIZATION**

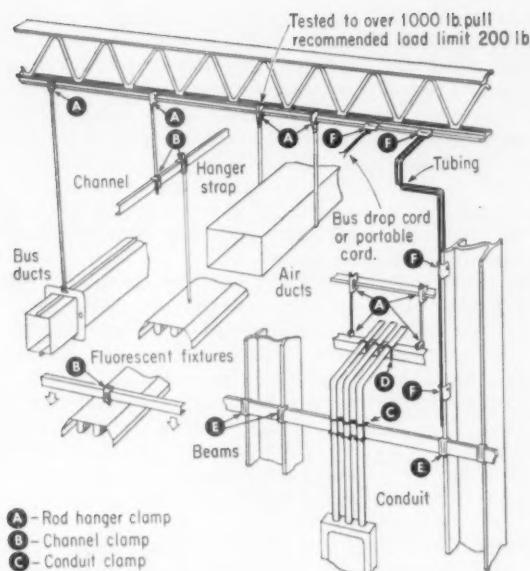
FASTENINGS AND SUPPORTS

FASTENING and supporting materials and equipment to building structures is one electrical construction category that invites a broad application of conventional power-tooling. Although measurable progress in this direction has been made in the past, the entire industry is constantly alert to improved techniques. Evidence of this abounds in the variety of improved hand and power tools and accessories now available to the construction trade. Supplementing this is a series of new and improved fastening devices offered by manufacturers. Add a more universal trade acceptance of labor-saving ideas and you have the basic combination for reducing field installation costs.

This category can be logically divided into two distinct classifications: tools and devices. In the tool group are those power units which are hand held and can be used anywhere on the job. Perhaps the most common and universal item is the electrical drill—an accepted "must" on every contractor's tool list. On most electrical construction projects there are from one to a dozen or more electric drills of different sizes, capacities and speeds depending upon the work involved and number of mechanics on the job. In fact, the electrical drill is rapidly becoming as important to an electrician's effectiveness as is his own personal tool kit. Some contractors have saved considerable time by supplying complete sets of twist

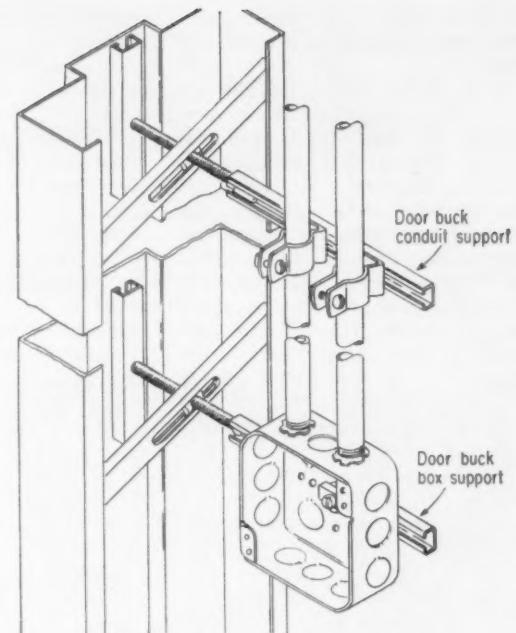
drills, charged out on requisition, for each drill sent out; others have furnished, where installation conditions warrant, dolly-carts for the drill kit and mechanic's tool chest.

New and improved attachments extend the usefulness of the conventional electric drill. Right-angle heads with speed-changing features permit drilling in limited spaces. Metal cutting hole saws, circular saw and reciprocating saw blade attachments reduce to a single operation many cutting tasks which formerly required multiple-drilling and hand sawing. Handy bench stands transform the unit into a drill press for fabrication work. By using carbide-tipped masonry drills, core units and diamond-tipped core drills, electric drills can efficiently



A - Rod hanger clamp
B - Channel clamp
C - Conduit clamp
D - Hold-down clamp
E - Bar clamp
F - Cable and tubing clamp

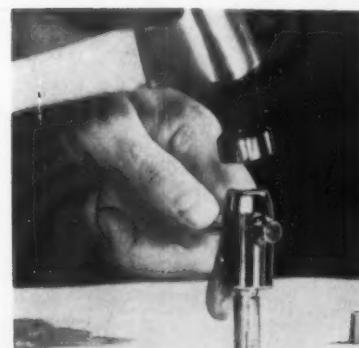
A VARIETY of clamping devices are currently available to simplify installation of electrical equipment and materials.



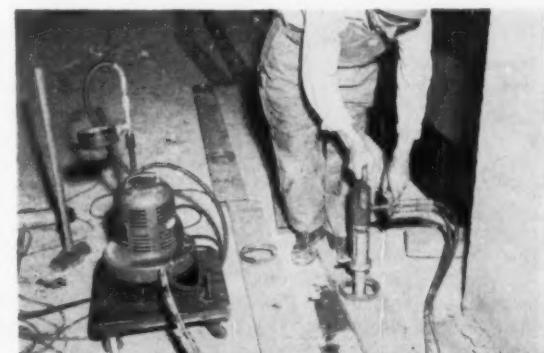
JACK-SCREW CLAMP simplifies supporting conduit and boxes to steel door bucks used in modern construction.



HAND SET with concrete nails speeds fastening of metal header duct to precast cellular concrete floor construction.



SELF-DRILLING metal anchor cuts own hole in masonry, then is withdrawn. Metal plug inserted in base expands anchor when it is driven in hole.



HYDRAULIC GROMMETING tools, designed by a contractor, flanges header duct steel grommets in a matter of seconds.

SIZE OF EXTENSION CABLE FOR PORTABLE ELECTRIC TOOLS

Based on current equivalent to 150% of full load of tool and a voltage drop of not over 5 volts. This table is for 110-volt tools. For 220-volt tools use wire size corresponding to an extension length of one-half the contemplated length.

Full load
ampere rating
of tool
Distance—Feet
(one way)

	0-2.0	2.1-3.4	3.5-5.0	5.1-7.0	7.1-12.0	12.1-16.0
					Wire Size (B & S Gage)	
25	18	18	18	18	16	14
50	18	18	18	16	14	12
75	18	18	16	14	12	10
100	18	16	14	12	10	8
200	16	14	12	10	8	6
300	14	12	10	8	6	4
400	12	10	8	6	4	4
500	12	10	8	6	4	2
600	10	8	6	4	2	2
800	10	8	6	4	2	1
1000	8	6	4	2	1	0

NOTE: If voltage is already low at source (outlet), have voltage increased to standard, or use a much larger cable than listed in order to prevent any further loss in voltage.

cut large openings in masonry construction (covered in a later section).

A variety of cutting, drilling and installation operations can be performed by the electric hammer, electric impact tool, electric nutrunner and screwdriver. Hammers are available in two designs: the solenoid type with its natural reciprocating motion; the electric motor type with a mechanism to convert rotary motion to sharp impact blows. Impact and nutrunning tools have high torque characteristics and clutch release devices which permit tapping, nutrunning, screw driving and similar operations.

Selection of proper type, size and capacity of an electric power tool is vitally important to efficient operation. If a tool is too small or "light" it may not do the prescribed job and may burn out. Adequate

maintenance and repair is another item to be considered. Many contractors have special tool repair departments to maintain their power tools in top operating condition.

Undersized extension cords is an important factor too frequently overlooked by contractors. Voltage drop will lower the efficiency of a power tool just as effectively as a dull twist drill or cutting edge. Use the accompanying table as a handy guide to selection of proper size conductors for long extension cords. For safety reasons, all portable electric tools should always be grounded either by means of a three-conductor cord and plug, or separate grounding conductor.

Use of an oxyacetylene torch is still considered one of the quickest methods of cutting steel, particularly heavy stock. Permission to use this should first be secured from the supervising architect or engineer.

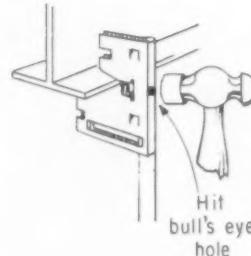
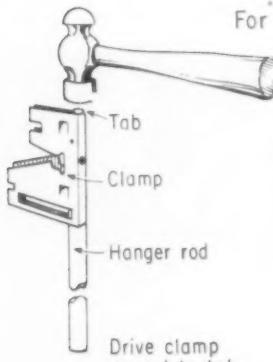
To preserve design strength, many structural engineers limit or definitely prohibit cutting, drilling or punching steel even for bolts or rod supports. Because of this, electrical contractors originally shifted to electric stud or spot welding, powder-actuated stud drivers, or a variety of clamp-type devices for fastening and supporting electrical equipment.

Electric welding has been used quite extensively for field and shop metal-to-metal bonding. Among many diverse applications: fastening supporting brackets and similar devices to structural steel; "tacking" outlet boxes and conduit supports to metal uprights for "deck" work; fabricating a variety of metal brackets for equipment supports.

Probably the most versatile and efficient fastening tool in current use is the powder-actuated stud

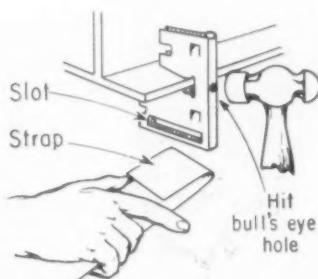
HANGER CLAMPS

For use with rods



Drive clamp and rod onto beam or joist

For use with straps



1. Drive clamp on beam
2. Hook strap in slot

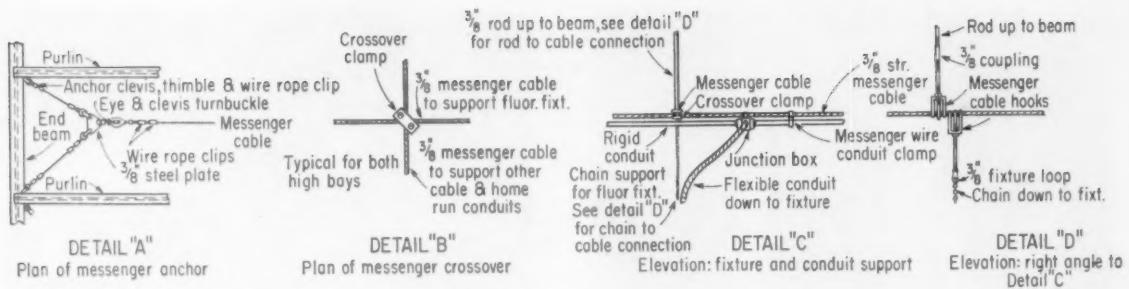
DRIVE-ON CLAMPS made of heat-treated, high-carbon steel slash to a minimum the tools and time needed to fasten supports to steel structures.



STUD GUNS solve fastening problems in tight places. Here, mechanic "shoots" stud in concrete column behind panel conduits.



PLYWOOD TEMPLATE with two cut-outs at each end to seat powder-actuated stud-gun guard substantially cut fixture's installation time.



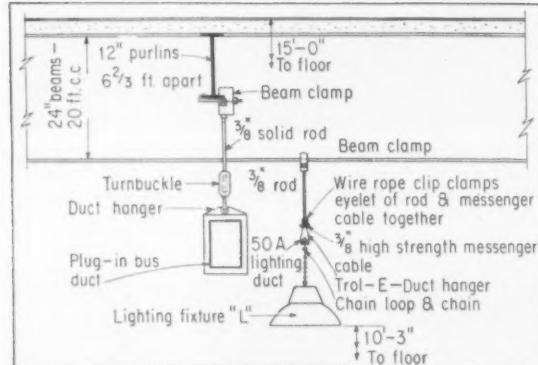
DETAIL "A"
Plan of messenger anchor

DETAIL "B"
Plan of messenger crossover

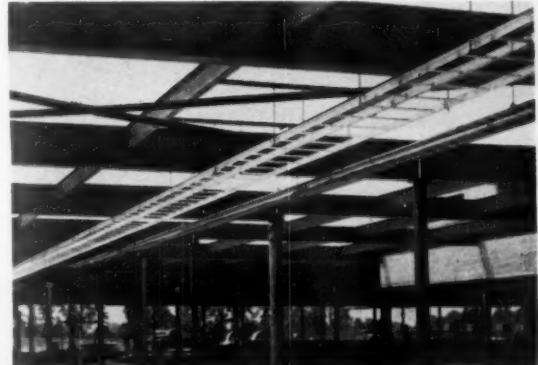
DETAIL "C"
Elevation: fixture and conduit support

DETAIL "D"
Elevation: right angle to Detail "C"

ANCHORING DETAILS of a messenger cable system designed and installed to support lighting circuits and fluorescent fixtures.



MOUNTING DETAILS of a beam clamp and suspension rod support method applied to an industrial plant plug-in power and lighting distribution system.



LADDER RACKS of light-weight metal simplify support of armored and insulated conductors; reduce heavy feeder and multi-circuit installation costs by replacing enclosed raceways.

driver. Light in weight and easy to handle in almost any position, it can be used to drive mounting studs in steel and a number of types of masonry construction. Selected cartridges provide power loads for light, medium, or heavy-duty fastening. A variety of stud types and sizes permit direct anchoring of materials, or driving of threaded (external and internal) studs for subsequent anchoring of supporting rods and brackets. Special guards are available for use with a number of electrical equipment items. Progressive design improvements and extensive field experience have eliminated much of the initial skepticism about the safety of this split-second fastening tool.

There always has been a variety of clamp-on devices for fastening equipment to steel members. Although normally listed as material items, such devices logically can be considered labor-saving "tools" when a broad definition of the term is applied. Latest addition to this rather extensive line of fastening devices is a family of "tap-on" or "drive-on" clamps made of heat-treated, high carbon steel. Only a

hammer is needed to fasten a rod, channel, bar or cable clamp to steel I-beams or bar joists or to drive an unthreaded suspension rod into the patented clamp.

Another perplexing fastening problem—that of supporting outlet boxes and conduits from steel door bucks used in modern building construction—has been solved by the recent introduction of an easy-to-install clamp designed specifically for that use.

Such items, seemingly insignificant at first glance, can effect a substantial man-hour economy on the installation phase of an electrical construction project.

Also falling in the time-saving fastening classification are such material items as concrete inserts, continuous channel framing, slotted angle framing, conventional angle and channel iron. They often are used in the structural sense to provide rigid supports for raceways, fixtures, etc., where long spans must be bridged and the number of suspension rods kept to a minimum; or as a rigid free-standing or structurally supported frame for control devices.

Continuous channel framing, with its sliding nut and bolt attachment feature, offers substantial equipment installation economy since no pre-measuring, punching or drilling are required. The same is true of slotted-angle framing with its array of pre-punched holes and slots to accommodate mounting bolts. Choice of method is a function of the economics of the job at hand. This type of framing is used extensively for multiple raceway support of the bracket or trapeze hanger design. It minimizes the number of structural anchoring points and, when of sufficient length, simplifies the installation of additional parallel circuits in the future.

Messenger cable systems still find ready application for supporting conduit, fixture and duct lines where structural conditions physically or economically limit the number of vertical hangers. Generally, this is for a single line of equipment and lacks the expansion flexibility of the continuous framing technique.

In addition to the gun-driven studs mentioned before, there are a



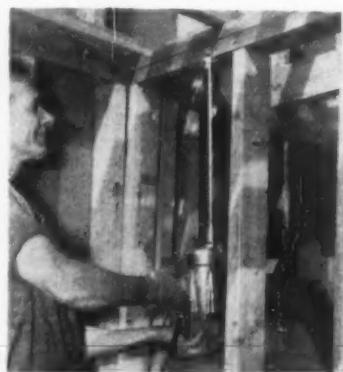
RIGHT-ANGLE attachment for electric drills reduces time and increases accuracy of hole cutting in top and bottom of this wiring trough; increases versatility of drills for working in close quarters.



ELECTRIC HAMMERS with up to 3600 blows per minute are available in a number of types and capacities for labor-saving masonry drilling, cutting and channeling. Some have automatic drill rotation.

number of different anchoring devices available for use in concrete, masonry, tile and a variety of wall constructions. Some are the self-drilling type; others require a pre-drilled hole. Whether hand or power tools are used depends upon the number of anchors involved, size of project and the economic considerations on each job. Each has its place and it is up to the contractor to make his selection accordingly.

Contractors attribute a progressive reduction of installation man-hours to: increased application of more power tools; development of new and improvement of existing techniques; selection of materials which feature installation ease.



SELF-FEEDING, long shank, bit on electric drill slashes vertical drilling time for EMT installation in structural frame of houses.



CONTINUOUS-CHANNEL brackets require few ceiling mounting bolts; simplify conduit installation; permit perfect alignment of parallel runs.

MACHINE SCREW AND MACHINE BOLT FASTENINGS—HOURS, EACH

3/16" 1/4" 5/16" 3/8" 7/16" 1/2"

Machine Screws in	
Steel, Drill and	
Tap.....	0.30 0.33 0.35 0.40 0.43 0.47

Machine Bolts in	
Steel, Drill.....	0.18 0.22 0.25 0.28 0.31 0.35

Powder Actuated	
Tool, Studs, Pins	0.04 0.04 0.04 0.04 0.04 0.04

Source: Electrical Construction Co., Manual—McGraw-Hill Book Company, 1958.



ALUMINUM RACKS for supporting cables can be pre-assembled in sections at floor level, easily raised into position for attachment to hanger rods.



TOOL CHECK LIST

- Benches, large, small, wood, metal—stationary, rolling
- Benders, pipe, tubing, hydraulic, mechanical, manual or power driven
- Block, snatch
- Block and tackle
- Burners, gas, acetylene
- Chains
- Chalk, chalk lines, crayons, marking materials
- Crimping tools—manual, hydraulic
- Dollies
- Drills, electric hand
- Drills, electric impact
- Drill presses
- Drivers, stud, powder actuated
- Forge
- Hacksaw, hand, power driven
- Hickeys
- Hammers, ball peen, claw, plastic and rawhide faces
- Hammers, electric, pneumatic
- Hoist, chain, manual, power driven
- Jacks, screw, hydraulic—manual and power driven
- Jigs and frames for assembling groups of fixtures and other equipment
- Levels, carpenters, surveyors
- Lift platforms, scaffold, boom, tower—manual or power operated
- Nut runners

- Power drive, universal
- Power drive adapter for use with $\frac{1}{2}$ -inch electric drill
- Pinch bars
- Plumb bobs
- Punches, knockout, mechanical, hydraulic—all sizes with dies
- Punches, Whitney for steel
- Saws, hack, band, knockout, skill, keyhole, masonry, carborundum, wheel—manual, power driven
- Scaffolds, rigid, rolling, stationary, sectional, telescopic
- Screw drivers, hand, ratchet—manual, power driven
- Shears, sheet metal, angle-iron—manual, power driven
- Sledges and hammers
- Stock, bolt, angle, channel, continuous channel framing
- Seals, conduit
- Splicing tools, soldering equipment
- Taps and tap wrenches
- Threaders, conduit, pipe—hand, power
- Torches, soldering, gas
- Tongs, chain
- Vises, pipe, machinist, power
- Welders, stud, spot
- Welding equipment
- Winches, manual, power operated
- Wrenches, pipe, socket, adjustable, Stilson S

COST-CUTTING JOB MECHANIZATION

ASSEMBLY TECHNIQUES

POWER tools, per se, are inherent labor-saving devices. When combined with carefully planned assembly and fabrication methods, their overall effectiveness can be increased substantially. Field experience among contractors shows that normal labor units can be reduced as much as 20%, or more, when relevant operations can be placed on an assembly-line basis.

Current practice takes full advantage of this installation concept by employing pre-fabrication and pre-assembly of electrical system components to the fullest extent.

Modular design of housing developments, office buildings and industrial plants with repetitive area layouts offers numerous opportunities for mass production techniques in electrical construction. As a result,

contractor field shops today resemble small scale assembly plants with centralized concentration of power tools and fabrication operations. The trend is to do as much work as possible at ground level and distribute assembled units or sections to installation points. By doing this, job supervisors find they can use available manpower more effectively and efficiently.



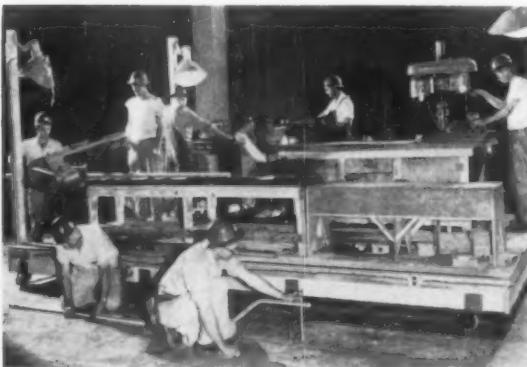
PORTABLE BELT-SANDERS clean bus bar ends in a jiffy. Polished areas are then silver plated for bolted connections.



SILVER PLATING of bus contact areas is accomplished in the field with portable brush electro-plating unit. Brush-pad saturated with silver nitrate solution leaves silver deposit when brushed across bar.



some contractors for bus offsets with **HAND BENDING** is still preferred by close dimensional tolerances in multiple-bar assemblies.



ROLLING WORKSHOP equipped with latest power tools provides electricians on a large project with a mobile fabrication and assembly center. Unit rolls along to follow installation progress.



SURVEYOR'S TRANSIT AND ROD are rapidly becoming standard "tools" for electrical contractors. Units simplify and speed up leveling of underfloor duct and header duct runs on small or large projects.

The number of work areas set up on a specific project depends on building construction (multi-story or sprawling single-story), type of electrical work involved, size of electrical crew and quantity of tools available. Tooling a project for highest installation efficiency is definitely a contractor responsibility. It is to his advantage to supply enough tools, materials and equipment to keep his men busy at all times. One contractor solved an exceptionally large area tooling problem by placing his mechanized fabrication center on a low, rolling platform which subsequently was moved from area to area as installation progressed.

Most adaptable to centralized production methods are these conventional operations: fabrication and assembly of brackets, racks, frames, suspension hangers and other material and equipment sup-

porting facilities; mass bending of conduit and tubing for parallel raceway installation; cutting, drilling, threading and plating (bus bar) operations; and a variety of assembly procedures.

Tool and equipment selection must be tailored to job requirements. An average field shop equipment inventory might include one or more of the following: power benders (for large pipe); hand benders (for smaller conduit); power threaders; power vises; metal cutting band and circular saws; grinding wheels; drill presses, assembly jigs and frames; metal punches; spot welders; assembly benches; and the normal complement of hand tools. These are primarily fabrication and assembly items. Other tools (discussed in other sections) and equipment for material handling, cable installation, etc., should also be on

the job site to maintain high overall efficiency.

Bus bar fabrication and assembly (for exposed-bus installations) can often be performed on a continuous production-line basis. On a large industrial installation, an enterprising contractor set up a conveyorized field assembly procedure with the following in-line work stations: circular-saw cutting table; multiple-spindle drill press; belt sanding table; silver-plating section; power bender station and assembly table. Bus bar, stored on a roller-table at one end, went down the roller-conveyor line, through the various fabrication operations, and emerged ready for assembly and installation at the other end. This same concept was adapted to similar installations on several other projects.

Roll-in trolley duct, a quick assembly and installation procedure



POWER DRILLING machine with diamond-tipped core drill makes short work of cutting holes in cellular concrete floor slab to match openings in transverse header duct.



METAL-CUTTING band saw on portable stand decreases manhours and increases cutting accuracy when tailoring underfloor duct, conduit and other raceway sections to prescribed requirements.



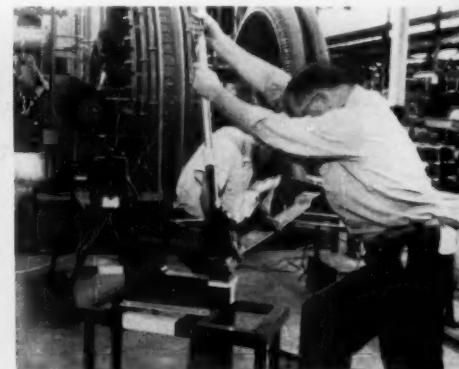
TANK-TYPE industrial vacuum cleaner is another handy electrical contractor tool item. Powerful vacuum sucks debris and water from drilled openings; lifts concrete plugs which may drop into cells.



BENCH TYPE drill press on wood skids is used effectively by electrician to cut openings with adjustable circle cutter in steel floor cells of building.



HOLE SAW on heavy-duty drill extension mandrel cuts openings in steel cell floor deck to match handholes in electrical header duct.



LEVER-OPERATED hole punches are a handy fabrication tool to have in the shop or in the field.

originally conceived by an electrical contractor, is an outstanding example of cooperative electrical industry endeavor to cut industrial plant lighting system installation costs. Now available in one or more types, this time-saving material "tool" presents a unique approach to relighting plants without interrupting normal production. Biggest advantage is that the duct can be assembled, connected and (with fixtures attached) pushed or pulled in pre-installed roller-hangers. All this can be done from a central station with minimum interruption to production workers below.

Not all pre-assembly and prefabrication operations are done in the field. Some contractors keep mechanized equipment setups in their own shop to fabricate and assemble on direct order from the field. This is particularly helpful when job conditions prevent setting

up efficient field operations. These tool items never leave the shop; they are retained to supplement the complement of tools and equipment normally sent to the job site.

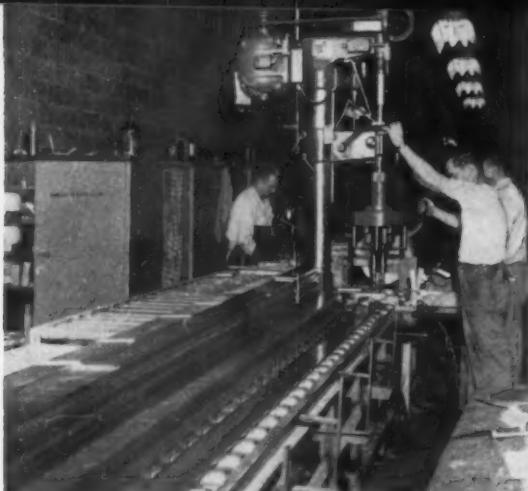
Field grouping of tools in a well-arranged work center is being used extensively whenever practicable. But this is not always the answer to the ultimate in job efficiency. In specific cases, use of power tools at point of installation may be more feasible. On a project street lighting installation, one enterprising contractor saved considerable time by using power coupling of conduit. A conventional pick-up truck bearing a portable-generator-operated power vise followed the streets where 1-in. conduit had been pre-spotted. With one length of conduit turning in the vise, mechanics progressively coupled up to 300 ft which was then "kicked" into the shallow trench behind curb line.

Under normal conditions a two-man team installed 6,000 ft per day.

Surveyor's transits and rods are being used extensively to level underfloor duct systems. Normally, one instrument has an effective working radius of about 400 ft compared to approximately 50 ft with the string or wire method. Transit teams of three mechanics have been known to level up to 2,400 ft of duct in about six hours.

Because of the variety of power cutting and punching tools now available, many contractors are ordering panel boxes or "tubs" without conventional stamped knockouts. They find it less costly to cut (holesaw) or punch (hydraulic punch) openings in the field, than to try to align conduit stubups and connecting nipples to match factory stamped knockouts.

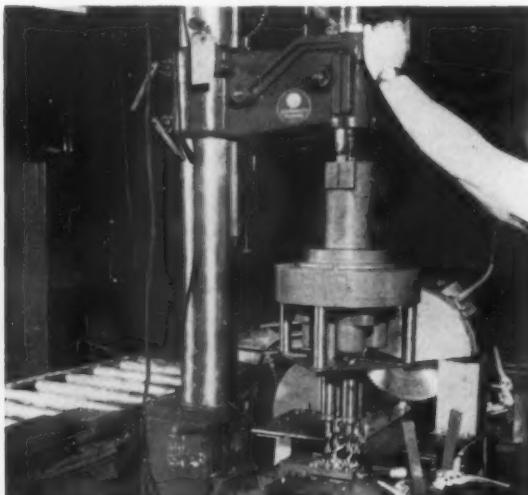
These are but a few of the numerous field examples of mechan-



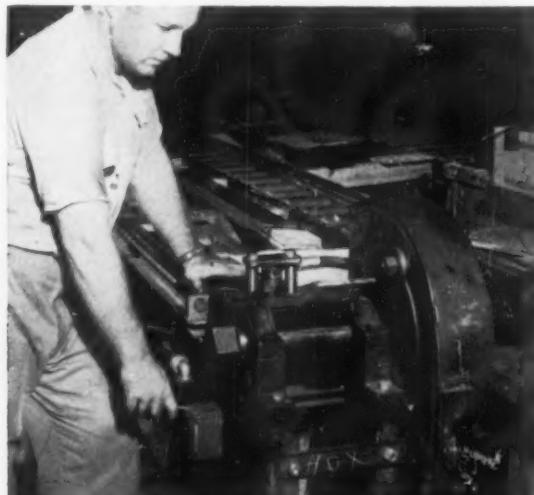
CONVEYORIZED ASSEMBLY line set up by a contractor to field fabricate bus bars for large electroplating installation. Bars go through work stations to final assembly table.



ABRASIVE CUT-OFF wheels are gaining popularity for cutting steel and iron. Metal circular saw attachments are still preferred for softer metals.



DUAL IN-LINE work station with multiple-spindle drill and circular saw cuts and drills copper bus in conveyorized field fabrication shop.



POWER BENDER at end of field fabrication line shapes bus bars to specified configurations for pre-assembly into installation sections.

CUTTING KNOCKOUTS—HOURS EACH

SIZE	WITH HAND CUTTER	WITH HOLE SAW	WITH HYDRAULIC CUTTER
1/2"	0.20	0.15	0.18
5/8"	0.25	0.17	0.21
1"	0.27	0.20	0.21
1 1/4"	0.29	0.22	0.21
1 1/2"	0.31	0.25	0.21
2"	0.40	0.30	0.25
2 1/2"	0.47	0.40	0.30
3"	0.55	0.50	0.35
3 1/2"	0.65	0.60	0.40
4"	0.75	0.70	0.45

NOTES: 1/2 in. pilot hole drilled for hand and hydraulic methods.

Electric drill used for pilot holes; double units if no electric drill is used.

Cost of hole saw included.

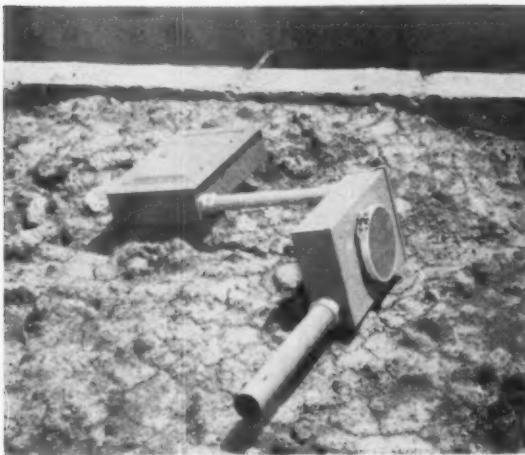
Source: Electrical Construction Cost Manual—McGraw-Hill Book Company, 1958

ized methods currently being used by electrical contractors. The record shows many more and the list grows bigger with each new project and each new idea that comes up. Although many ideas and techniques originate on the so-called "big jobs," the basic principles involved can be adapted economically to smaller projects.

The contractor is not alone in his quest for new ideas and techniques. Tool and equipment manufacturers are backing him with improved product designs aimed at cutting installation cost. Better mounting facilities, more work space and better accessibility for maintenance indicate a growing respect for contractor field problems.

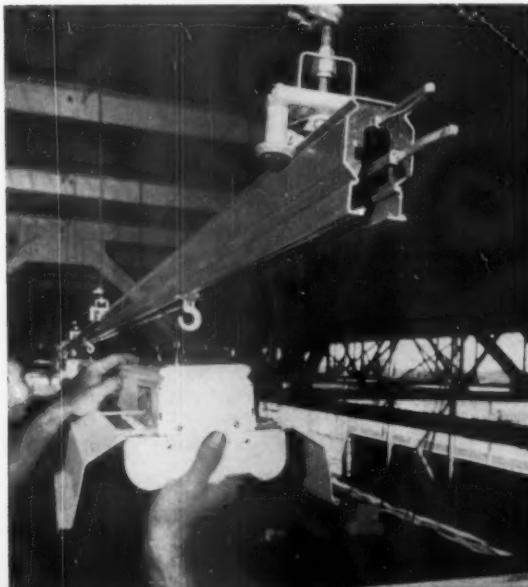


PRE-ASSEMBLY of trolley duct couplings and fixture hooks for roll-in system is done on roller table at base of work station. Hooks are spotted with a template.



PRE-ASSEMBLED permanent service entrance components (outdoor meter and indoor panel) are dropped at housing project foundations for connection to underground service. Panel on temporary support supplies power during construction.

ROLL-IN SYSTEM for industrial plant trolley duct and fluorescent fixtures cuts normal installation time in half. Duct and fixtures at one work station per line are winch-pulled or pushed into pre-installed roller hangers.



HYDRAULIC KNOCKOUT cutter quickly punches holes in panel "tub" for accurate alignment with floor conduit stub-ups; is handy time-saving tool on most construction projects.



PLUNGE CUTTING with electric hack saws or bayonet saws having reciprocal or orbital motion makes pocket openings for outlet boxes in single operation; eliminates drilling and hand sawing.

WIRING TROUGH at ceiling matches metal trough (other half) cast in ceiling to terminate slab conduits. Method eliminates conduit turn-downs and subsequent alignment and adds flexibility in connecting of home runs.





TOOL CHECK LIST

- Abrasive wheels—metal cutting
- Band saws, metal cutting, power operated
- Benders, pipe and tubing, mechanical, hydraulic, manual and power driven, large and small
- Cutters, conduit, tubing—hand and power operated
- Hacksaws—hand power operated
- Hickeys
- Hole saws
- Knockout punches, hand, hydraulic—standard, C-clamp
- Power drive, universal for cutting, threading, reaming pipe
- Power drive adapter—attachment to pipe threader
powered by standard $\frac{1}{2}$ -inch electric drill
- Pushers, pipe, hydraulic—manual and power driven
- Reamers, pipe
- Stocks and dies—various sizes
- Threader, pipe, manual and power driven
- Threading machines, pipe, power driven
- Vises, pipe, claw and chain; power driven
- Wrenches, pipe, chain tongs, adjustable, Stilson

COST-CUTTING JOB MECHANIZATION

CONDUIT AND RACEWAYS



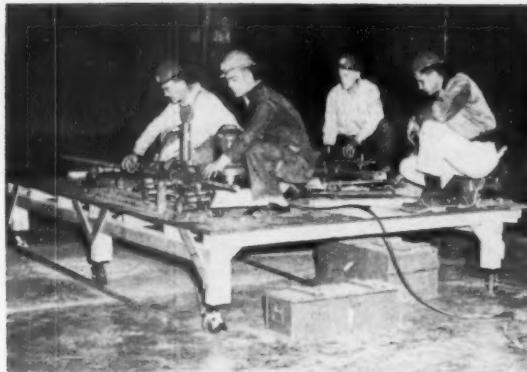
PRE-BENT conduit sections, mass produced in conduit fabrication area, are bundled, tagged and stacked on dual-tier mobile rack for spot delivery to installation points.

CUTTING, threading, bending and fabrication of conduit raceways were among the first electrical construction operations to enjoy the advantages of mechanization. What formerly required the sturdy back and strong arms of a rugged mechanic can now be done with the mere flip of a lever or switch. Modern power tooling has eliminated fatigue as a manpower factor. Today, expended man-hours become a factor of a machine's capabilities rather than man's physical capacity. Even the conventional hand threading and cutting tools become "mechanized" when used with a power vise.

Methods of cutting conduit range from the standard hand hack saw to the speedy metal cutting band saw. Even more efficient, in some cases, is the high-speed abrasive cut-off wheel familiar to industrial operations. The current trend, as

noted in a previous section, is to mass produce electrical system assemblies in a centralized fabrication area, then distribute these to installation points. Housing, apartment and other projects with a multiplicity of identical conduit runs present a "natural" field for this type of operation. On some projects, mechanics were seen cutting whole bundles of small conduit and tubing with one setting of a metal cutting band saw. For cutting large size conduit, the band saw has almost universal acceptance in the trade; is about ten times faster than a reciprocating power hack saw. It is not unusual to find two, three or more band saws on a single electrical job.

Hand methods are still used on jobs which, in the contractor's opinion, do not merit a high degree of mechanization. Even here, the use of light-weight, easy-to-move



ROLLING BENDER platform has power benders to handle variety of conduit sizes; provides effective mobility for large area building projects. Matching cutting and threading centers can be added.

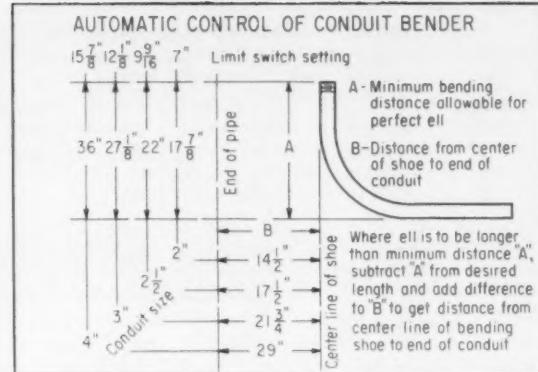


POWER PUMPS reduce heavy conduit bending to a "watching" chore. Mechanic merely operates control lever on pump while watching bend develop.

power vises can quickly mechanize the conventional hand cutting and threading tools.

Conduit threading is another operation in which considerable progress has been made. Today power units are available to solve practically every threading problem and in price ranges to fit the tool budget of all contractors, large and small. Conventional threading machines are now much lighter in weight and easier to transport; do a more efficient cutting and threading job; find ready application in contractor field shops where mass fabrication operations are necessary.

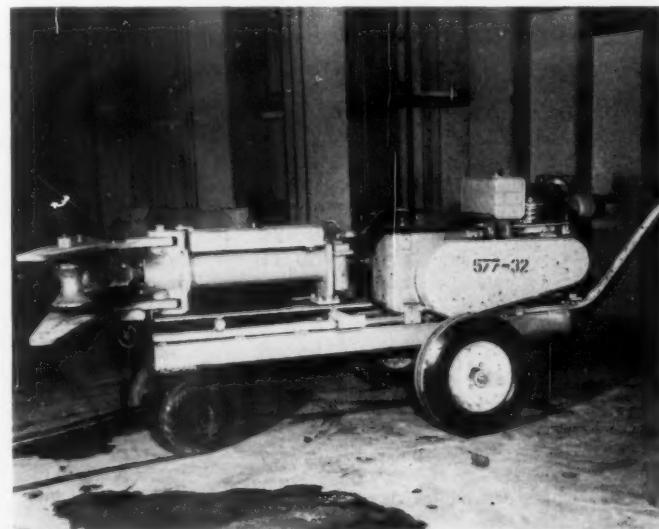
For field threading at point-of-installation, light-weight (20 to 26 lbs) hand-held, portable threaders are used extensively. These handy, reversible-motor units can be used with a series of adaptors to operate dies and conventional geared threaders for up to 6-in.



GUIDE CHART like this, developed for a specific automatic, repetitive, hydraulic conduit bending operation, establishes limit-switch settings for different size conduit; cuts set-up time.



HAND BENDING can be the most efficient approach to making on-the-spot offsets on specific projects. Units like this portable pedestal-bender take up to three sizes, permit accurate control, are fast-loading and easy to use.



GASOLINE MOTOR powers this large hydraulic bender mounted on rubber-tire undercarriage. Unit can be moved almost anywhere on paved or dirt fill surfaces. Bender power unit slashed manual operating time by 60%.

BENDING PRESSURES (LBS) AND RAM TRAVEL (INS.) FOR ALUMINUM CONDUIT

CONDUIT SIZE	15° Bend		30° Bend		45° Bend		60° Bend		75° Bend		90° Bend	
	Pressure	Travel	Pres- sure	Travel	Pres- sure	Travel	Pres- sure	Travel	Pres- sure	Travel	Pres- sure	Travel
1½"	100 lbs.	2¼"	200	3¾"	220	4¾"	250	6½"	275	7¼"	300	8½"
2"	200	2½"	225	4"	300	5-7/16"	375	6¾"	400	8"	425	9¾"
2½"	400	2-11/16"	500	4¾"	600	6"	650	7¾"	700	9½"	800	10-7/16"
3"	600	3"	700	4-15/16"	800	6¾"	900	8½"	1000	10"	1200	11½"
3½"	700	3½"	800	5-9/16"	1000	7¾"	1200	9½"	1300	11-3/16"	1400	12¾"
4"	1000	3-9/16"	1100	6½"	1300	8½"	1600	10½"	1900	11-15/16"	2350	13-9/16"

Center Radius of the Shoes and Center to Center of Pipe Supports

Conduit Size	Center Shoe Radius	Center to Center Pipe Supports
1½"	8¼"	23.62"
2"	9½"	27.62"
2½"	12½"	31.62"
3"	15"	36.00"
3½"	17½"	40.00"
4"	20"	44.00"

Notes: Data taken with a Greenlee No. 884 power driven hydraulic conduit bender.

Source: Greenlee Tool Company; Kaiser Aluminum & Chemical Sales, Inc.

COMPARATIVE INSTALLATION COSTS MANUFACTURED ELBOWS VERSUS FIELD BENDING OF CONDUIT

Conduit Size	INSTALLATION COSTS—Dollars						SAVINGS THROUGH FIELD BENDING—Dollars		
	Manufactured Elbows			Field Bending			Per Elbow	No. of Bends	Total Savings
Elbow and Coupling	Elbow and Coupling	Labor	Total	Material	Labor	Total	Per Elbow	No. of Bends	Total Savings
2"	\$2.05	\$4.68	\$6.73	\$0.88	\$1.44	\$2.32	\$4.41	50	\$220.50
2½"	3.78	6.37	10.15	1.65	1.80	3.45	6.70	123	824.10
3"	6.34	8.42	14.76	2.25	2.02	4.27	10.49	60	629.40
3½"	11.39	10.37	21.76	3.05	2.56	5.61	16.15	40	646.00

Notes: Evaluation made on a new hospital project—1957
Source: Dietz Electric Co., Inc., Milwaukee, Wis.

Total Savings \$2,320.00

conduit; have attachments to drive cable winches and earth augers. Another advantage is that they can efficiently thread "in place" conduit either overhead, in trenches, or wherever a 12-in. work space is available to the mechanic. On projects where threading of larger conduit is a fairly moderate requirement, some contractors find a gear-drive adaptor kit works well. This is a portable gear-drive which can be attached to conventional geared-threaders normally used on larger conduit. A conventional ½-in. electric drill furnishes the power through special mandrels which fit the drill chuck and slotted collars on the gear drive. These and other developments have reduced threading time to an absolute minimum. In the process they have converted what was once considered a "rough" job to practically a push-button operation.

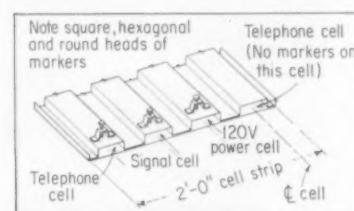
The same can be said of conduit bending—if proper equipment is

used. Addition of power pumps and the integration of angle-gauges on hydraulic benders has made heavy conduit bending a "watching" rather than an arm-weary "pumping" chore. Bends can now be made up to three times faster than with the hand pump. Development and refinement of the "one-shot" 90-degree offset principle (longer ram travel and special shoes) has drastically cut actual bending time (4-in. conduit, one minute or less). In

fact, the increased efficiency of conduit bending equipment has led many contractors to substitute field bending of conduit for manufactured elbows and offsets. Mobile platforms or "bending tables" frequently are used to support one or more hydraulic benders to meet job requirements.

Since fewer cuts, threads and couplings are needed, overall raceway installation time is substantially reduced. To this can be added the saving of waste conduit pieces.

An actual project case study dramatically illustrates the economics involved. A motor-operated, "one-shot" hydraulic bender was used to fabricate 273 90-degree bends in 2-in. through 3½-in. conduit (about one-half of the bends were in 2½-in. conduit). Comparative installation costs showed a contractor estimated savings of some \$2,300 (an average of about \$8.50 per bend) over use of factory el-



CELL MARKERS of different pattern quickly identify raceways of specific electrical systems; simplify circuit installation and maintenance.

bows. According to records, about 60% of this overall saving was reflected in labor.

On another project involving a multiplicity of duplicate bends, the contractor's field superintendent practically "automated" the operation. He installed a limit-switch system which automatically stopped ram thrust at predetermined points to make the proper bends. To help mechanics make perfect 90-degree bends in different size conduit, he developed a chart showing limit-switch settings for each conduit size involved.

The use of lighter metals in modern bender construction is a definite advantage to field efficiency. Most sizes can now be transported by one man and even carried up a ladder for overhead bending of "in

place" conduits. This latter approach is particularly time-saving on parallel conduit runs where space limitations prevent normal rotation of pre-bent sections during the coupling operation. Hydraulic hand pumps are normally used on overhead work. Hand, foot and power pumps also are used on a series of hydraulic knockout punches for cutting conduit openings in metal enclosures. Latest development in this field is a "one-shot," light-weight C-clamp type punch with an 8-in. deep throat which fits around the edge of a box or "tub." Tool has spring-return ram for fast operation; eliminates pre-drilling and step-up punching operations normally required.

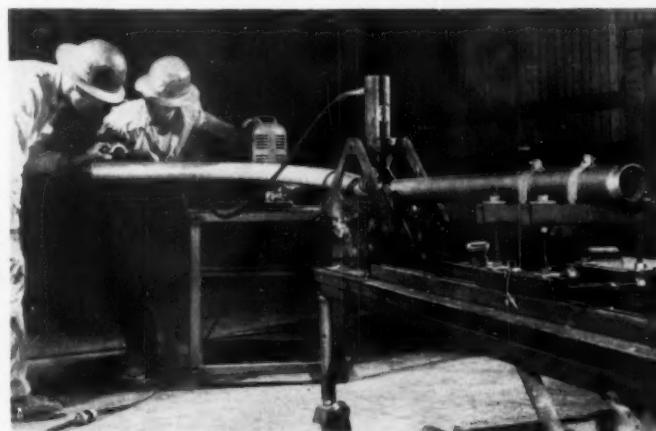
Where bending is confined to smaller conduit, hand benders (1½

in. or less) and hickeys (1-in. or less) are still considered the most efficient tools. This is particularly true for on-the-spot bending where offsets must meet construction requirements and mass bending techniques are not essential. Improved mechanical features such as ratchet and toggle arrangements to shorten stroke and improve leverage, convenient working-height stands and other advances simplify the hand operation.

Conduit and raceway system design is another factor which has a definite bearing on overall electrical system installation economics. Large, roomy pull and junction boxes, offset troughs, long sweep ells will often cut cable installation time and minimize possibility of insulation damage.



LIGHT-WEIGHT features of modern power bender design permit convenient in-place offsets on overhead conduits to meet installation conditions.



PIPE DOLLY on this mobile bender table supports and "inches" conduit through hydraulic bender while mechanics make "off-beat" bend to critical dimensional requirements.



MOBILITY OF HEAVY TOOLS is a key to efficient contractor field operations. This pneumatic-tire, bender cart and table has permanently mounted heavy-duty hydraulic power bender with facilities for storing full complement of shoes and bender accessories.



RATCHET BENDERS with built-in angle-gauges permit short, powerful strokes for faster hand bending of conduit. Base can be bench mounted or supported on legs.



TOOL CHECK LIST

<input type="checkbox"/> Blocks, snatch	<input type="checkbox"/> Re-reeling equipment
<input type="checkbox"/> Block and tackle	<input type="checkbox"/> Rope, hemp, steel
<input type="checkbox"/> Brakes, cable	<input type="checkbox"/> Rollers, reel
<input type="checkbox"/> Cable lubricants	<input type="checkbox"/> Rollers cable—for pulling cables on racks
<input type="checkbox"/> Cable marking labels	or in troughs
<input type="checkbox"/> Conveyors, roller type for pulling cable	<input type="checkbox"/> Saws, hack
<input type="checkbox"/> Compressors, air	<input type="checkbox"/> Solder
<input type="checkbox"/> Crimping tools, cable, wire	<input type="checkbox"/> Soldering pliers, electric
<input type="checkbox"/> Cutters, wire, cable	<input type="checkbox"/> Soldering devices, chemical
<input type="checkbox"/> Grips, wire and cable, basket mesh, comealongs	<input type="checkbox"/> Solder paste, irons, pot ladle
<input type="checkbox"/> Insulating sleeves	<input type="checkbox"/> Splicing tools, kits, compound
<input type="checkbox"/> Jacks, screw, reel, gang, payout, manual, hydraulic	<input type="checkbox"/> Strippers, wire
<input type="checkbox"/> Knives for stripping cable insulation	<input type="checkbox"/> Tape, fish, steel—manual and hydraulic
<input type="checkbox"/> Measuring machine, wire, cable	<input type="checkbox"/> Tape, insulating, rubber, friction, plastic, varnished cambric, linen, cotton, asbestos
<input type="checkbox"/> Pullers, cable—mechanical, power drive	<input type="checkbox"/> Torches, alcohol, gasoline, soldering, gas
<input type="checkbox"/> Pulleys and sheaves for cable and wire	<input type="checkbox"/> Welding equipment
<input type="checkbox"/> Plow, cable laying	<input type="checkbox"/> Winches, hand and power driven
<input type="checkbox"/> Reel trailers, carts	

COST-CUTTING JOB MECHANIZATION

CABLE HANDLING

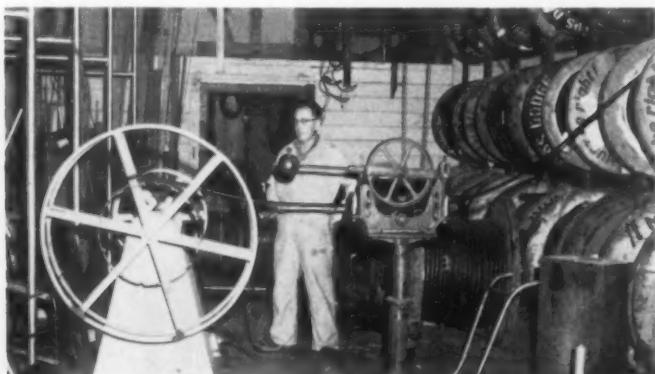
TYPE of equipment and techniques used have a definite bearing on whether conductor or cable installation will be an easy, difficult, simple or complicated operation. Prime consideration is to avoid damage to insulation or protective sheath during installation.

This applies to all cable work whether it be in exposed or concealed conduit, ducts or wireways, or supported in open air by insulators or cable troughs.

Several factors influence cable installation methods. Among them are: raceway system design; num-

ber, location and size of pull and junction boxes; length of raceway; number and type of offsets; size, weight and number of conductors or cables; available space for reel and winch setups; limitations of the cable handling tools and equipment on the job. Choice of equipment and technique is a responsibility of the electrical contractor or his field superintendent.

Installation methods are many and varied; are normally tailored to the specific project at hand. For multi-story risers, two techniques are available. Where space, floor design and hoisting facilities permit, cable reels can be set up on the top floor with the winch in the basement. This method takes advantage of cable weight and gravity pull, reduces capacity of winch required, and may cut pulling time considerably. However, a well-coordinated reel-braking system should be used to prevent cable "run-away" and possible snagging and insulation damage. The other



RE-REELING UNIT in contractor's shop takes measured cable from stock reels and rewinds it for field installation. One, two or three conductors can be reeled simultaneously by power unit.



PORTABLE POWER WINCH with dual speed drive has adjustable boom and pulley attachment braced against conduit terminal for downward cable pull. Winch crew communicates with reel crew



CABLES FED INTO underground ducts get ample application of proper cable lubricants; are protected from abrasive damage by pipe roller on top of manhole wall.



ELECTRIC WINCH attachment on fork lift truck "elevator" simplifies pulling conductors in overhead raceways. Winch can be raised or lowered for best pulling angle; can be quickly moved to next box.

method, considered by many contractors to be the safest and easiest controlled, is to reverse the procedure and pull up against cable weight. Proponents of this technique point out its inherent safety, although it may increase pulling time.

For horizontal runs, the straight-through pulling technique has become an accepted method of cutting manhours from cable installation time. With one reel and one winch setup, conductors are pulled "straight-through" junction boxes from one end of the conduit run to the other. Right-angle turns can be incorporated in the single pull if offset boxes of sufficient sizes are installed (an important design consideration). When this is done, the conductors pass around a large-diameter, wide-face, wooden pulley anchored inside the box. Contrast this with the conventional method of pulling at the pull-box, feeding the conductors back in again and pulling at the end of the run. The latter requires two winch setups and the time of a crew paying-out and feeding the conductors at the pull-box. Cost savings are obvious.



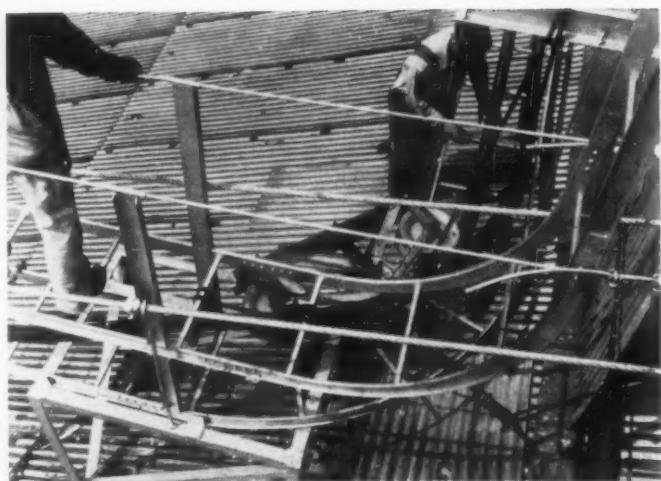
ROLLER FRAME tops indoor manhole; speeds cable installation; prevents abrasion damage to conductor insulation; permits feeding cables from either side.

With the aid of pulley assemblies at turns and strategically spotted detachable rollers along the line, the same straight-through method can be applied to interlocked armor and insulated multi-conductor cables installed in cable trays or racks. Continuous runs of 500 ft, 750 ft and more have been installed in this manner.

Maintaining a steady pulling tension and constant speed to keep cable in continuous forward motion is an acknowledged "must" for successful conductor installation. If the pull is made in "hitches" with intermittent stops, the forward motion advantage is lost. After each stop, the inertia and frictional resistance of the cable dead-weight must be overcome. That is one of the reasons why the power winch has become such an effective tool. A combination of careful cable payout, application of proper cable lubricants and modern high-capacity winch equipment will generally permit uninterrupted continuous pull operation.

Pulling equipment varies with the size and type of job. It can range from the conventional fish-tape pullers for small circuits to hand operated clamp-on winches and power winches operated either by conventional power units or built-in integral motorized equipment. Where working conditions permit, truck winches are still used effectively. Next to capacity, important factors in winch selection are portability and setup ease—two items which can substantially affect installation manhours. One unit, considered most efficient from an overall standpoint by a number of contractors, is a mobile (four detachable wheels) motorized heavy-duty winch with a multispeed drive and an adjustable boom and pulley attachment to meet practically all cable installation problems. Add to this the number of different power drives for lighter winches and you have impressive array of equipment available for contractor use.

Numerous advances have been made in the art of "fishing" conduits and ducts. The steel fish-tape is still an important tool for relatively short runs. On longer conduit runs, compressed-air devices—"parachute" for larger pipes and a cloth doubling as a swab for smaller conduits—force a fish line through in a matter of seconds. Most recent addition to this group of time-saving devices is a gun-



COMBINATIONS OF pulleys and rollers facilitate continuous-pull installation of cables in open trays and racks; cut pulling time drastically.



PORTABLE THREADER DOUBLES as power drive (with proper attachment) for hand-operated cable puller. Aluminum conduit extension-clamps to raceway.



FISH TAPE REEL gives mechanic positive grip and tape control when pulling circuit conductors; speeds conductor installation without damage to tape or hands.

fired, jet-propelled cartridge which pulls a strong nylon cord through the raceway, bends and offsets included. The cord is then used to hand-pull a fish-rope through the conduit. Choice of method still depends on the job conditions and "tools" at hand. The trend is definitely toward cutting this time-consuming chore to an absolute minimum.

Reel handling—spotting and payout—is another operation which has become highly mechanized. Many contractors find it more economical, both from a cost and time standpoint, to reel cable for specific job needs from their own cable stock. Some have built their own motorized reeling machines with single or partitioned (for more than one conductor) reels for field use. Others use units already on the market. In any case, cable is

passed from stock reels through a cable-meter to the reeling unit to assure accurate lengths. Where time is not so important, and required cable is not in stock, contractors frequently order cable "factory-cut and reeled (one or more conductors per reel, as required) for direct delivery to the job site.

Development of special tools for cable terminations has substantially cut cable-connection time. Mechanical indenters (for small wire) and hydraulic compression tools (for larger conductors), when used with the popular compression-type connectors and lugs, reduce termination time to a matter of a few seconds or minutes. And the use of convenient conductor and circuit tags and labels eliminates circuit identification confusion during installation and subsequent maintenance.



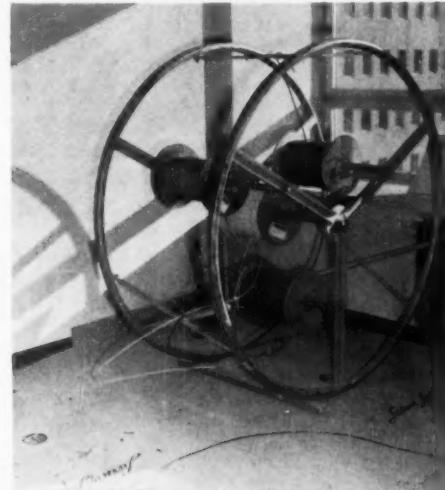
WINCH TRAILER with gasoline motor driven winch has carriage overhang and shaft extension to center capstan drum over manhole or conduit stubups. By reversing rope hitch on capstan, mechanic can pull cable from two directions.



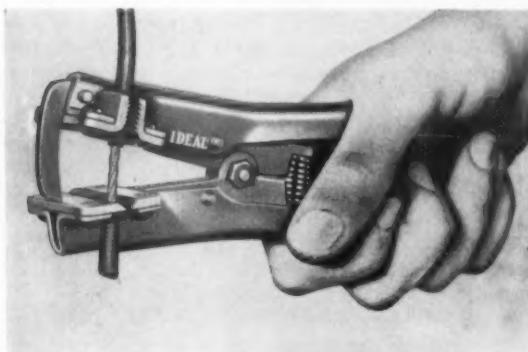
CABLE SPLICING in an overhead pull box is a "snap" with a hydraulic compression tool. Here, one mechanic holds compression head on splicing sleeve while other applies pressure with foot-pedal pump.



LIGHT-WEIGHT CABLES require fewer installation manhours, particularly in overhead raceways. Here, mechanic feeds three aluminum conductors into conduit with relative ease.



HOOP FRAME reel carrier takes eight or more branch circuit conductors at a time, depending on size of reels or spools. Unit rolls easily through doorways, corridors and from room to room for wire installation.



WIRE STRIPPERS save minutes on lug and pigtail connections; eliminate nicking conductor strands; permit sizeable man-hour savings on trim work.



PRINT YOUR OWN identification labels tailored specifically to functional requirements as you go along. Hand labeler embosses plastic or metal pressure-sensitive tapes or tapes



TOOL CHECK LIST

<input type="checkbox"/> Air compressors, gasoline driven	<input type="checkbox"/> Plow, cable laying
<input type="checkbox"/> Air hammers, drills and complement of air tools	<input type="checkbox"/> Power drives, portable, for winches
<input type="checkbox"/> Augers, various sizes and sectionalized lengths	<input type="checkbox"/> Pulleys and sheaves
<input type="checkbox"/> Bulldozers, small, for backfilling trenches and excavations	<input type="checkbox"/> Pushers, pipe, hydraulic—manual or power operated
<input type="checkbox"/> Benders, pipe, hydraulic—hand, power	<input type="checkbox"/> Reel trailers and carts
<input type="checkbox"/> Blocks, snatch	<input type="checkbox"/> Rollers, cable protection at manholes
<input type="checkbox"/> Block and tackle	<input type="checkbox"/> Rope, hemp, wire
<input type="checkbox"/> Braces, trench, adjustable	<input type="checkbox"/> Saws, wood, rip, crosscut, masonry
<input type="checkbox"/> Bullpoints	<input type="checkbox"/> Sledge hammers
<input type="checkbox"/> Chains	<input type="checkbox"/> Shovels, long and short handled
<input type="checkbox"/> Crowbars	<input type="checkbox"/> Tape, fish, steel, manual, pneumatic
<input type="checkbox"/> Digging machines, clamshell scoop, trenching units	<input type="checkbox"/> Torches, gas, acetylene, cutting, welding
<input type="checkbox"/> Generators, portable, gasoline driven	<input type="checkbox"/> Tongs, chain
<input type="checkbox"/> Goggles, safety	<input type="checkbox"/> Trenchers, jeep attachment, conventional self or hand propelled
<input type="checkbox"/> Gloves, safety	<input type="checkbox"/> Trailers, highway type for storing tools and materials, low boy for hauling slow moving mechanized equipment
<input type="checkbox"/> Jacks, screw, hydraulic—manual, power	<input type="checkbox"/> Trucks, standard, heavy duty, winch, reel
<input type="checkbox"/> Levels, carpenters, surveyors	<input type="checkbox"/> Welding equipment
<input type="checkbox"/> Picks	<input type="checkbox"/> Winches, power operated
<input type="checkbox"/> Pinch bars	<input type="checkbox"/> Wrenches, pipe, chain, adjustable, Stilson

COST-CUTTING JOB MECHANIZATION

UNDERGROUND WORK



HEAVY-DUTY TRENCHER cuts clean furrow from transformer vaults to house foundations while electrician lays service cables. Unit also was used for primary underground distribution for 6,000-home project.

INITIAL operations for underground electrical work normally involve some type of excavating and trenching for ducts, manholes, direct burial cables, openings for pipe pushing equipment or buried enclosures for transformers or circuit control equipment. Since the man-hour differential between hand labor and machine operation is so great, almost all trenching and excavating is now done with power equipment.

To take advantage of this labor-saving method, electrical contractors acquire trenching equipment for temporary or permanent use. Some, engaged in intermittent underground jobs, find it economical to rent equipment for a single project or limited use on a number of current projects. Others, who normally specialize in this field or anticipate substantial future work of this type, purchase such equipment outright even though the

initial investment is substantial. Realistic tool-cost charges against individual job use result in a reasonable write-off period. Firms with such equipment available at all times find themselves in a much better competitive position when figuring underground work.

Selection of equipment depends on the size of the construction project and the specifics of the underground system requirements. Large trenching and excavating machines are not always necessary. Much of the electrical contractor's trenching can be done with the lighter self-propelled trenching units or Jeep trenchers (Jeep truck with trenching attachments). The latter can cut clean swaths through most earth compositions; have been known to average 100 ft, or more, per hour; have the advantage of high-speed highway movement, under their own power, from job to job. Popularity of direct burial



SELF-PROPELLED medium-weight trencher averages 4 ft per minute in normal soil; is rugged enough to cut through block-top streets; has blade attachment for backfilling. Adjustable digging boom cuts trenches from 3-in. to 8-in. width, and to 5-ft depth.



HAND-PROPELLED light-weight trencher is easy to transport; slashes short-run (100 ft or less) trenching costs to a minimum; also used on long runs. Unit digs 3-in. swath up to 24 ins. deep at speeds from $1\frac{1}{2}$ to 17 ft per minute depending on soil conditions.



JEEP TRENCHER on highway lighting project cuts parkway shoulder at average rate of 100 ft per hour in winter weather. Unit has advantage of high speed movement from job to job.

cables and the current trend toward underground electrical service to homes, recreational fields, drive-in theaters, etc., has opened a market for light-weight hand-operated power trenchers. Several are available. Some are hand-propelled, others self-propelled. Weights

range from about 232 lbs to 650 lbs; trenching speeds from 1 to 12 ft per minute, or more, depending on soil conditions; trench widths from 2 to 8 ins., depths from 2 ft to 5 ft. Some models have small "dozer" blade attachment for backfilling. Units can be trailer-trans-

ported or easily loaded on conventional $\frac{1}{2}$ -ton pickup trucks.

Backfilling of trenches has become highly mechanized with the bulldozer or "power pusher" becoming a favorite piece of equipment. On a residential street lighting project with an inside-the-curb

MIDGET TRACTOR with rubber treads and "dozer" blade rides sidewalks to backfill street-lighting trenches; does the work of eight to ten hand laborers. Light trailer transports it from job to job.



HYDRAULIC BOOM TRUCK with small clam-shell scoop attachment digs opening for pipe pusher; is also used to unload and raise poles and lighting standards; has hydraulic outriggers for stability.



trench, the contractor solved backfilling by using a midget bulldozer with rubber treads that would not damage the walk or lawn area. One man on this unit did the work of eight to ten laborers. When direct-burial cables are installed, backfilling must be done more carefully to prevent stone and rock damage to the cable. Normally cables are nested in and covered with a layer of sand, or covered with creosoted planking before the fill is replaced. Frequently, pneumatically-operated tampers are used to pack the backfill.

In the past, excavating for manholes and access holes for pipe pushers, etc., was a pick and shovel job. Today, power equipment has taken over. On one highway lighting project, sizeable "holes" to seat pipe pusher equipment were dug in matter of 10 to 15 minutes with a small clam-shell scoop on a hydraulic boom truck. When not "digging" the boom truck was used elsewhere to unload and set poles and standards. Multi-purpose equipment is a contractor favorite. Versatility means added use and less equipment inventory.

One of the most versatile pieces of equipment seen on a street lighting job was a 4-wheel, rubber-tired tractor with an air compressor, pneumatically operated boom for pole setting, pneumatic rotary-head attachment for a pole-hole auger, an earth auger for drilling under sidewalks in narrow cable trenches and facilities for operating a host of pneumatic tools. Well equipped contractors actively engaged in underground work recognize the need for an ample supply of hydraulic and pneumatic tools. Air compressor trailers, with accessories for air hammers, soil tampers, pneumatic fish-line devices and other tools, have become standard electrical contractor field equipment items.

Where conduits must be installed under existing roadways or sidewalks, a hydraulic pipe pusher is usually the first "tool" to be considered. Recent improvements and refinements of hydraulic power pumps (both gasoline and electric motor powered) have slashed "pushing" time considerably. Greater speed range, faster ram approach, and higher pressures are now available on units that can be mounted on a rubber-wheeled undercarriage for job mobility. While hydraulic pushers can oper-



BULLDOZER SCOOPS excavations for semi-buried transformer vaults in about 15 minutes. Unit was used extensively on underground distribution system for 6,000-home residential project.



HYDRAULIC PIPE PUSHER shoves 45 ft of 3½-in. conduit under a 26-ft city street. Gasoline-motor driven power pump, on portable undercarriage, provides "pushing" pressure. No street trenching was needed.

ate in most soil or fill compositions, hard packed sand fill presents an obstacle. When this is encountered, contractors have effectively used compressed-air rotary drills with auger attachments to tunnel through the fill before installing the conduit. As a result of current re-

search in this field, hydraulic pipe pusher designers may come up with a solution to this problem.

Cable handling and winch equipment for pulling in underground conductors are, with few exceptions and possible refinements, similar to that used on "inside" work. Out-

TRENCHING—Cost per Foot in Dollars

METHOD	COST, \$
MACHINE TRENCHING —Continuous trench in normal soil	
Up to 500 ft.....	0.10
1,000 ft.....	0.07
3,000 ft.....	0.06
Over 3,000 ft.....	0.055
Notes: 6" trench, 4'-6" deep; 8" trench, 4' deep; 14" trench, 3'-6" deep. Add 10% for excessive short runs.	
HAND TRENCH —Spade width, 3-ft deep	
Common Labor (\$1.75 per hour).....	0.60
Electrician (\$3.00 per hour).....	1.00
PUSHING CONDUITS —Hydraulic	
3" or 4" galv. rigid conduit (est. 0.65 hr/ft).....	1.90

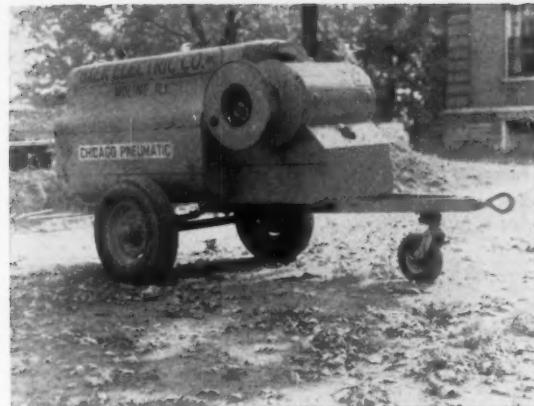
Source: Electrical Construction Cost Manual—McGraw-Hill Book Company, 1958.



EARTH AUGER tunneling under sidewalk is powered by versatile, portable, threading unit. Accessories convert popular threader to convenient power drive.

doors, truck winches and gasoline-powered individual units predominate. To facilitate cable pay-out, one electrical contracting firm designed and had built a special reel-truck with hydraulically operated "arms" to suspend cable reels over manholes. Repeated setup time was eliminated and the truck could move quickly, over rough terrain, from one feed-in location to the next. With an integral winch and re-reeling attachment, the truck could be used for cable pay-out, cable pulling, or removal of cables.

Even a casual observation of current underground electrical installation projects reveals this important fact: Mechanization is the key to economical operations.



AIR COMPRESSOR trailers, large and small, are rapidly becoming a standard electrical contractor field equipment item to operate pneumatic hammers, soil tampers, augers, etc.



REEL TRAILER towed by jeep truck speeds installation of underground residential service conductors in large-area home project. Reel has three conductors which are unreeled and cut according to field requirements.



SPECIAL REEL TRUCK has hydraulically positioned "arms" to suspend one or more cable reels over manhole for easy pay-out; eliminates repeated set-ups and moves quickly.



POWER WINCH on line truck pulls conductors in underground ducts. Winch cable passes over pulleys to get most effective pulling angle and direction.



TOOL CHECK LIST

<input type="checkbox"/> A-frames	<input type="checkbox"/> Hand Lines
<input type="checkbox"/> Augers and diggers, pole hole	<input type="checkbox"/> Jacks, pole pulling
<input type="checkbox"/> Augers, pole hole, truck mounted	<input type="checkbox"/> Ladders, aerial
<input type="checkbox"/> Bars, metal, tamping and digging	<input type="checkbox"/> Live line safety tools
<input type="checkbox"/> Belts, lineman's	<input type="checkbox"/> Measures, pole
<input type="checkbox"/> Blankets, rubber	<input type="checkbox"/> Pike Poles
<input type="checkbox"/> Block and tackle	<input type="checkbox"/> Pole jenneys and mules
<input type="checkbox"/> Borers, earth	<input type="checkbox"/> Pruning tools
<input type="checkbox"/> Buckets, canvas tool	<input type="checkbox"/> Pulleys and sheaves, wire stringing
<input type="checkbox"/> Cant hook	<input type="checkbox"/> Pullers, slack
<input type="checkbox"/> Cars, cable stringing	<input type="checkbox"/> Reel carts
<input type="checkbox"/> Cutters, wire, cable	<input type="checkbox"/> Rope, hemp, steel
<input type="checkbox"/> Derrick trucks, pole setting, digging	<input type="checkbox"/> Saws, power chain
<input type="checkbox"/> Drills, pole hole	<input type="checkbox"/> Shovels, pole hole and spoons
<input type="checkbox"/> Drivers, ground rod, guy anchor rod	<input type="checkbox"/> Splicing tools
<input type="checkbox"/> Flares, lineman's	<input type="checkbox"/> Spurs, lineman's climbing
<input type="checkbox"/> Gin poles	<input type="checkbox"/> Tension Indicator dynamometer—wire tension
<input type="checkbox"/> Gloves, lineman's	<input type="checkbox"/> Towers, hydraulic
<input type="checkbox"/> Gloves, rubber	<input type="checkbox"/> Trailers, reel, pole, dolly
<input type="checkbox"/> Grips, wire and cable	<input type="checkbox"/> Tractors
<input type="checkbox"/> Hoists, pole top, adjustable transformer, ratchet lever	<input type="checkbox"/> Trucks, line, service, ladder
	<input type="checkbox"/> Wrenches, assortment

COST-CUTTING JOB MECHANIZATION

POLE AND LINE WORK

POLE and line work is becoming an increasingly important phase of an electrical contractor's overall operation. While line contractors are acknowledged specialists in this field, more of the so-called "inside contractors" are

encountering line work in extensive or limited outdoor, overhead intra-plant distribution between buildings. Even the residential and rural electrical contractors are called on to set a pole or two to get long-span service conductors from

the utility lines to the service entrance. And the increase in street, highway, and tollway interchange lighting, plus recreational area and parking lot lighting, is opening a vast market to all electrical contractors.



TRUCK BOOM with telescopic pipe adjustment and power winch makes short work of setting poles. Hinged jacks under truck bed stabilize unit for heavy loads.



HYDRAULIC CRANE on truck with side outriggers swings over road shoulder to spot and raise lighting standard. Truck parallels roadway, permitting free traffic flow in other lanes.



ONE MAN DIGS pole hole in matter of minutes with power auger on truck which can move quickly to next location. Auger-rigs can be tractor mounted for rough terrain.



ALIGNING RIG clamps and centers itself on tapered lighting standard. When four plumb bobs are equidistant from pole base, pole is perpendicular in both planes.



TELESCOPIC BOOM platform, highly maneuverable, raises luminaire and electricians to pole top position. Equipment like this sped relighting of a business thoroughfare.

Some contractors sub-contract this work to established specialists with engineering staffs and equipment geared to efficient volume operation. Others have set up a separate department equipped to handle pole and line work. Many take

it in stride with their normal type of work. Regardless of how it is done, mechanization is the key to cost-cutting field operations. Proper tools, equipment and trained mechanics must be used. Linemen possess vastly different skills and tools than the conventional "inside" electrician and the two cannot be switched back and forth. Neither can the materials and equipment, generally speaking. One handles and installs poles, lighting standards, strings conductors, operates pole hole diggers, boom trucks, tractors, etc.; the other installs conduits and raceways, motor controls, distribution panels, pulls in wire, works from scaffolds and platforms.

Like underground work, heavy power equipment combined with carefully planned installation techniques substantially reduces field man-hours. Boom trucks, mobile hole boring rigs, heavy reel trucks and trailers, and cable tractors are the line contractor's major mecha-

Recommended Pole Setting Depths in Soil and Rock for Various Lengths of Wood Poles

Length of Pole in Feet	Setting Depth in Soil in Feet	Setting Depth in Rock in Feet
20	5	3
25	5	3.5
30	5.5	3.5
35	6	4
40	6	4
45	6.5	4.5
50	7	4.5
55	7	5
60	7.5	5
65	8	6
70	8	6
75	8.5	6
80	9	6.5

Source: Lineman's Handbook, 2nd Edition, McGraw-Hill Book Company



TWIN CROW'S NESTS, made of insulating laminated Fiberglas, at the end of a hydraulically operated jack-knife boom raise electricians to top of pole assembly in perfect safety and stability. Duplicate controls in nest and at truck bed control boom movement.



AERIAL EXTENSION ladder on truck provides stable platform footing for electrician working on pole-mounted transformer; features time-saving mobility.



MAGNETIC DRILL PRESS sticks to steel column while mechanics pump hydraulic feed to drill through $\frac{3}{4}$ " steel. Safety chain supports drill when magnetic power is off to shift to new hole position. Steel poles were being extended in height.



WELL EQUIPPED lineman has full complement of hand tools and accessories in his belt, sharp climbing spurs and a sturdy safety belt. All should be carefully checked at regular intervals.

nized equipment items. Today, pole and guy anchor holes are dug in a matter of minutes with power augers; poles are being set with boom trucks using half the crew needed for the hand piking methods. More assembly work is being done on the ground. Transmission towers are being erected in pre-assembled sections hoisted into position by power booms. Cross-arms, pole hardware, lighting brackets, and even luminaires are being installed at ground level before the pole is set. Reel trucks constitute mobile conductor pay-out stations. Dynamometer dials assure proper line tension on long spans. This is but a quick glimpse of a few mechanized techniques that have a major impact on cost control of line construction.

Street, highway and parking area lighting involves a combination of methods. With the current trend toward underground distribution, circuit installation will follow tech-

niques outlined in a previous section (Underground Work). Equipment and methods used to set the lighting standards will be much the same as those outlined above. Lighting standards are completely preassembled (bracket arms, luminaires and accessories) and pre-wired on the ground. Truck booms are used to set the standards and

the final connections are made at the base. For this type of work, the swing-type hydraulic boom has become a contractor favorite.

New ideas and refinement of techniques develop with almost each new project. The common goal is increased safety to personnel, better workmanship, reduced installation time and lower overall costs.

APPROXIMATE LENGTHS OF TIE WIRES

Type of Tie	Conductor Size	Length of Tie Wire
Western Union	3/0 bare cable	54 inches
	2,000,000 CM cable	87 inches
Bridle	4/0 bare cable	54 inches
	2,000,000 CM cable	87 inches
Horseshoe	All sizes	39 inches
Armored Western Union	All sizes	102 inches
Armored Top	All sizes	114 inches
Stirrup	All sizes	Two Pieces, each 54 inches

Notes:

Use insulated ties with insulated line conductors; bare ties with bare line conductors; copper ties with copper line conductors; aluminum ties with aluminum line conductors. Tie wires should be made of soft-annealed wire.

Tie Wire Size: No. 6 for line conductors No. 4 and smaller; No. 4 for line conductors No. 1 to No. 4; 2 tie wires for line conductors No. 1/0 and larger.

Source: Lineman's Handbook, 2nd Edition, McGraw-Hill Book Company.



BRACKETED STEEL FRAME on plant roof anchors incoming high-voltage circuit; supports service conduit to indoor unit substation below.

GUYING POLES—Effect of Lead on Tension in Guy and Earth Uplift

(Assuming a horizontal constant force of 1000 lbs.)

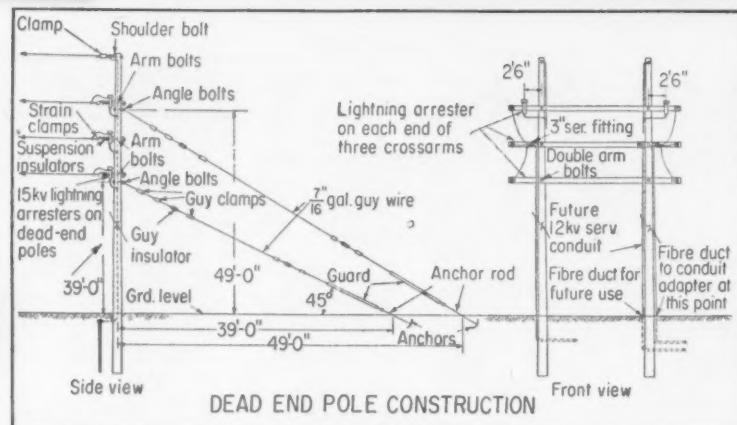
Height of Guy Feet	Lead of Guy, Feet— Pole Base to Anchor	Load in Guy, Pounds	Uplift in Earth, Pounds
30	5	6180	6000
30	10	3160	3000
30	15	2240	2000
30	20	1800	1500
30	25*	1560*	1200*
30	30*	1410*	1000*
30	35	1320	860

Note: Best loading conditions are indicated with an asterisk *

Source: Lineman's Handbook, 2nd Edition, McGraw-Hill Book Company



STEEL DEAD-END structure with twin guys terminates overhead yard distribution and supports conduits carrying circuits underground to building switchgear. Wood H-pole structures are used in similar manner.



DETAILED DRAWINGS like this simplify a contractor's job; speed field work. This gives pertinent information on construction of a dead-end pole H-structure.



COMPLETELY ASSEMBLED street lighting standard, including bracket, luminaire and transformer is raised into position by hydraulic swing-boom.



ELEVATING PLATFORM on line truck swings out over sidewalk so mechanic can make final adjustments to newly installed street lighting unit.



AERIAL PLATFORM attaches to truck brackets for standard pole derrick; raises men and material to working position on pole; increases versatility of line truck.

TALL BOOM on contractor's truck raises transmission tower section in place. Pre-assembly of sections at ground level typifies time-saving approach to line construction work.





Tool and Equipment Check List

TOOLS—A normal complement of tools (see preceding section lists) for type of wiring at hand

EQUIPMENT

- Portable generators—gasoline driven
- Temporary service equipment—meter, disconnects, etc.
- Receptacle centers—fuse or circuit breaker protected, 3-wire grounding type, twist-tight type receptacles and plugs
- Pigtail sockets for lighting
- Long extension cords—3-wire, grounding type
- Wire and cable—feeders and branches

COST-CUTTING JOB MECHANIZATION

TEMPORARY POWER FACILITIES

TEMPORARY power is the key to efficient cost-cutting job mechanization on construction projects. Previous pages listed an array of power tools used by electrical contractors. Other trades have a similar list pertinent to their

own operations. Unless a well designed temporary power system is available at the job site, the advantages of power tooling fade and anticipated man-hour reductions vanish.

The electrical contractor is generally responsible for providing adequate service (utility or portable generator), distribution and branch circuit facilities for use of all trades. Unless definitive temporary power specifications are available (and they seldom are), he must estimate all requirements and design and install the system accordingly. Frequently, large power equipment such as electric welders and material hoist motors might be encountered.

Where utility lines are within reasonable distance, temporary service equipment can be installed. Where this is not possible, gasoline-driven, portable generators can be used until a permanent power line is brought to the property line. Sometimes portable generators are kept on a project as a spare source of limited power should regular service fail, or for limited use in remote points where extension of temporary power circuits would be impractical. All these factors must be carefully evaluated in the estimating stage so adequate provisions can be included.



POWER POSTS are made up in groups to serve construction tools on multi-story project. Each post contains circuit breaker panel with 3-wire, grounding receptacles flush in sides of panel box.



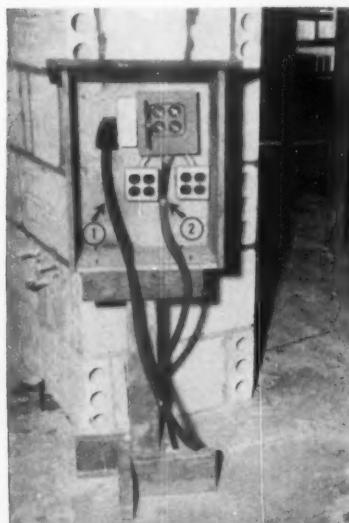
TEMPORARY ELECTRIC service facilities can range from mobile trailer substation (left) to detachable service mast on contractor trailer (center) or outdoor or indoor temporary service set-up; to portable gasoline-driven generators (right) of proper kilowatt capacity.

Methods of installing temporary power systems vary with contractor and project. Standard practice is to string open wiring around a structure for feeders. On multi-story buildings, some contractors pull temporary feeders in spare riser conduits and tap off to branch circuit "posts" or "pedestals" at pull box openings on various floors. Others use "power pedestals" at each floor with plug-in feeders

(range cable and receptacles) between pedestals. The trend is away from "pigtail" sockets for power tools. Instead, 3-wire, grounded receptacle centers are now being used with receptacles protected by branch circuit breakers or fuses at the pedestals.

One important factor is common to all temporary power distribution regardless of system used. All conductors—feeders, branch circuits

and long extension cords—must provide adequate capacity and minimum voltage loss for efficient tool operation. (See Chart—Size of Extension Cable for Portable Electric Tools, Fastening and Supports Sections.) For safety reasons, the system should be well grounded and all cords, plugs and receptacles should be the 3-wire, grounding type, preferably the twist-tight design.



PLUG-IN PEDESTAL provides four 3-wire duplex receptacles for tools on floor area; has plug-in feeder (1) for pedestal above; is fed by similar No. 6, 3/c cable with 50-amp range plug from pedestal on floor below.



UNDERGROUND SERVICE assembly on temporary foundation-mount has temporary receptacles for builder's construction tools. Service was first thing installed and connected. Houses were built around service equipment in 6,000-home project.



TOOL CHECK LIST

<input type="checkbox"/> Benches, work, stationary, rolling	<input type="checkbox"/> Hammers, manual, electric, pneumatic
<input type="checkbox"/> Benders, conduit, tubing, bus—mechanical, hydraulic manual or power operated	<input type="checkbox"/> Indenter tools, tubing connector
<input type="checkbox"/> Block and tackle	<input type="checkbox"/> Labels & tags—conductor, raceway
<input type="checkbox"/> Boxes, tool and material storage—stationary or rolling	<input type="checkbox"/> Ladders, A, step, rigid, extension, mobile
<input type="checkbox"/> Bullpoints	<input type="checkbox"/> Lug tools, cable, wire—mechanical, hydraulic
<input type="checkbox"/> Burners, gas, acetylene	<input type="checkbox"/> Platforms, extension, lift, hydraulic
<input type="checkbox"/> Cable pullers	<input type="checkbox"/> Reel carts
<input type="checkbox"/> Cable jumpers—to maintain service during alterations	<input type="checkbox"/> Saws, wood, concrete, metal and hole cutting
<input type="checkbox"/> Cutters, cable, conduit, tubing, knockout—manual or power operated	<input type="checkbox"/> Screw drivers, hand, ratchet
<input type="checkbox"/> Cut-off shears, angle and flat steel stone, surface raceway, etc.	<input type="checkbox"/> Screws and bolts, assortment
<input type="checkbox"/> Compressors, air	<input type="checkbox"/> Scaffolds, adjustable, rigid, rolling, stationary, sectional, telescopic
<input type="checkbox"/> Cords, extension	<input type="checkbox"/> Stock, bolt, angle, channel, continuous channel framing, slotted angle
<input type="checkbox"/> Dollies	<input type="checkbox"/> Threaders, conduit, bolt, hand, power
<input type="checkbox"/> Drills, electric, impact, pneumatic	<input type="checkbox"/> Towers, rolling, hydraulic lift type with platform
<input type="checkbox"/> Drills, wood, steel, concrete	<input type="checkbox"/> Torches
<input type="checkbox"/> Drivers, stud, powder actuated	<input type="checkbox"/> Welding equipment
<input type="checkbox"/> Electric welder, stud	<input type="checkbox"/> Winches
<input type="checkbox"/> Goggles, safety	<input type="checkbox"/> Wrenches, assortment suitable for work at hand
<input type="checkbox"/> Gloves, safety	

Note: Choice of tools for alteration work depends upon the type of electrical construction involved: conduit, underground or overhead, line work, etc. For additional tools in these categories see Tool Check Lists in other Sections.

COST-CUTTING JOB MECHANIZATION

ALTERATION WORK

FOR the purposes of this discussion the term "alteration" will encompass all electrical work done in existing structures, whether the project be complete rewiring, system rehabilitation, or merely additions to or extensions of existing circuits. Regardless of scope, work of this type seldom, if ever, is as clear cut as new construction. Existing structural and job conditions, stringent space limitations, and working without disrupting normal plant production or disturbing building tenants are problems an electrical contractor must face and solve.

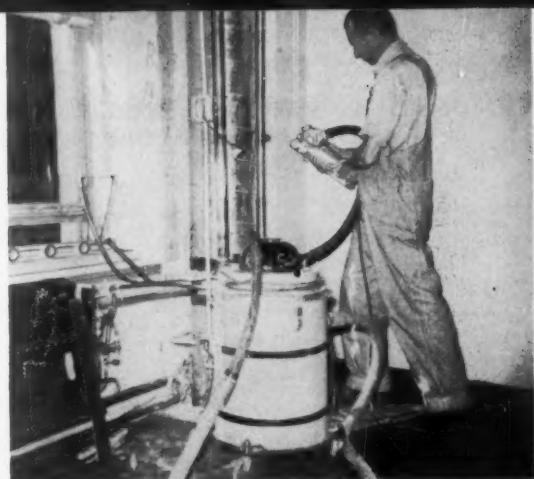
This is one area of construction where the field-engineering talents, installation know-how and construction experience of the electrical contractor are key factors in cost-control. In fact, close cooperation between contractor, engineer and owner with respect to routing of circuits, placement of equipment and working facilities is almost a prerequisite to reasonable installation economy.

From the electrical contractor's standpoint, alteration work can be simple or complicated, profitable or unprofitable, almost in a direct relation to the way the project is organized, equipped and handled. Power tooling and modern installation methods are his biggest weapons in the constant battle to control installation man-hours. The better equipped firms usually show the better profits while improving their place in the competitive field.

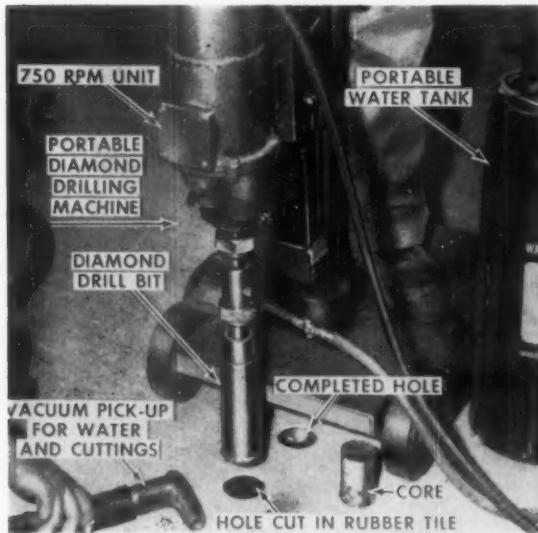
Most alteration projects involve a substantial amount of cutting and patching, especially on multi-story buildings. This is one operation where modern power tools can be used to greatest advantage. Progressive design improvements and refinements in masonry drilling equipment have made hole cutting almost a "snap" field operation. Typical examples: One contractor cut a 5-in. dia hole through 35-in. reinforced concrete with a diamond core drill in 35 minutes actual drilling time. Total time, including rig setup, removing core sections from drill and adding drill rod extensions, 120 minutes per hole. On another job, 150 3½-in. dia holes were drilled through a tough 10-in. concrete floor at an average drilling



CONCRETE SAW channels slabs in matter of minutes; has adjustable depth control and cutting edge water spray; can be powered by gasoline or electric motor.



PLASTER GROOVER makes quick, clean cut without cracking adjacent wall area. Unit has twin cutters adjustable for channel width and vacuum cleaner to remove dust.



PORTABLE DRILLING MACHINE with diamond core bit cuts 2½-in. hole in 3½-in. concrete slab to reach cellular steel floor cells for electric circuits. Average drilling time per hole, 2 minutes; average holes per bit, before resetting, was 140.



ANCHOR-MOUNTED drill rig speeds cutting smooth holes through masonry wall, even from step-ladder perch. Ammeter on unit indicates proper drilling speed and pressure, warns against overload.



DRILLING IN TIGHT places with a concrete drill. Jack-screw pedestal supports drill in horizontal position. Extension shaft on bit spans inaccessible area between post and wall.



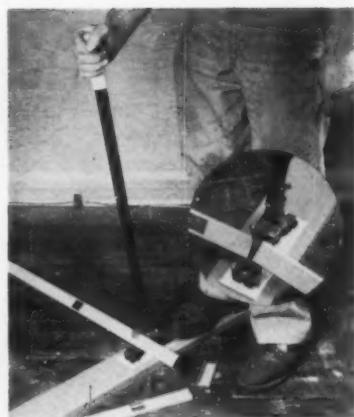
QUICK PRESSURE on shear lever snips slotted-angle to predetermined lengths in seconds. Angle is used extensively to support raceways, controls and other electrical equipment.

RECOMMENDED SPEEDS AND PRESSURES FOR DRILLING CONCRETE WITH CORE DRILLS

Drill Size in Inches	Electric Drill Size	Drill Speed in R.P.M.	Suggested Applied Pressure in Pounds
1/4" to 7/16"	1/4" or 1/2" light, medium or heavy duty	500 to 750	50 to 200
1/2" to 13/16"	1/2" light, medium or heavy duty	300 to 500	150 to 500
5/8" to 1 1/8"	1/2" or 3/4" medium or heavy duty	200 to 500	250 to 700
2" to 2 1/4"	3/4" heavy duty	100 to 300	300 to 800
2 1/2" to 4 1/2"	1" or 1 1/4" heavy duty or equivalent rotary air motor	100 to 300	300 to 800
4 1/4" to 6"	2" rotary air motor or equivalent	60 to 125	750 to 2000

Note: If possible, apply pressure with lever or jack mechanism

Source: Tilden Tool Manufacturing Company



20 SECONDS PER cut is the on-the-job average for marking and cutting multi-outlet surface raceways with this dual-action shear. One side cuts the raceway base; the other, the cover. Inset shows closeup.



POWER CABLE PULLER solves pulling problem in limited space. Unit attaches to pull box conduit, has pipe pedestal supports, permits one-man operation.



LIGHT-WEIGHT hydraulic conduit benders can be carried up ladders with ease; permit economical overhead bending of in-place conduits when feasible.



VERSATILITY of the portable power threader frequently allows use and extension of existing in-place conduits for rewiring purposes.

time of 7½ minutes per opening; total time per hole, including setup, 30 minutes. On a large office building project, 8,400 2½-in. dia holes were drilled through a 3½-in. concrete cap over cellular steel floor to reach cell wireways. Average drilling time per hole, 1½ to 2 minutes. What formerly took numerous hours now requires only minutes.

Concrete saws channel floor slabs in a jiffy; dual-cutter electric plaster groovers, with vacuum cleaner attachments, now channel plaster walls and ceilings in a quick, clean, efficient manner.

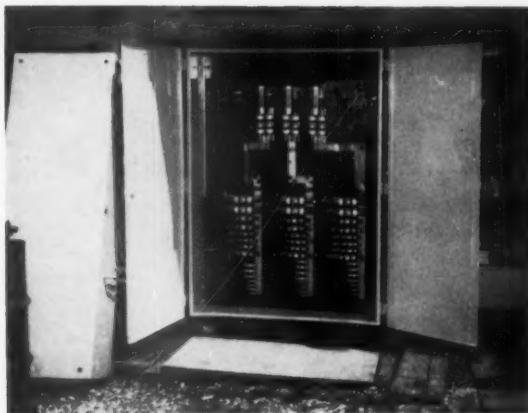
Light-weight hydraulic bending equipment can now be carried up

a ladder for overhead offsets on in-place conduits. Portable power threaders can thread in-place conduit raceways. Many operations, formerly impractical from a physical or economic standpoint, are now more or less commonplace.

The list of applied tools could go on. It is long. The ones cited are merely a few to illustrate some of the more "dramatic" time-saving operations. Practically every tool and method mentioned in previous sections may be used in alteration work. Choice of tools is governed by the specific work to be done and the job conditions encountered. This is the responsibility of the con-

tractor or his field engineer. Man-hour economy is the ultimate goal.

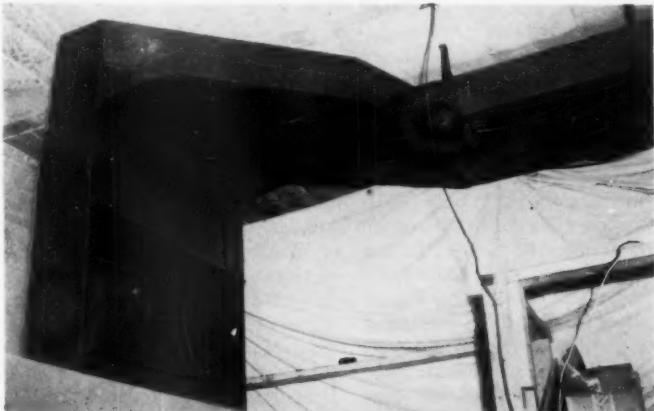
Although tooling and mechanization account for a good percentage of time saved in the field, contractor know-how and installation engineering have a very definite impact on over-all project efficiency. Electrical systems for alteration projects must be tailored to fit building and structural design. Carefully designed pull boxes or cable troughs can often reduce a complicated raceway problem to a simple installation and provide cable-pulling economies also. A combination of tools, methods and ingenuity is the cost-control formula.



MOBILE CABINETS like this distribution panel are used by contractors to maintain essential electrical service during switchboard changeover or other alteration work.



PRY-OUT TONGS loosen room baseboards without damaging wall plaster. Contractor developed "tool" to facilitate installation of receptacle circuits in older homes.



DOUBLE-OFFSET TROUGH carries feeder cables from new switchboard to distribution panels in rewired plant; solved awkward multiple raceway problem.



DRILL-POWERED diamond core bit, operated in confined space, quickly cuts smooth holes in building floor slab without disturbing normal routine of tenants.



DISTRIBUTION FLEXIBILITY is provided in 30-year old building by installing flush-type underfloor duct on existing floor slabs. Added concrete pour is level with top of duct.



EQUIPMENT CHECK LIST

- Motor scooters and bicycles
- Intercom systems—job site
- Radio—mobile, 2-way
- Radio—portable, 2-way for job site use
- Telephone—conventional, sound-powered
- Trucks—small, for on-the-job use

COST-CUTTING JOB MECHANIZATION

JOB COMMUNICATION

MOBILITY, speed and efficiency are key factors in the modern electrical contractor's continuous battle against time. This applies to his lines of job communication as well as his specific mechanized installation techniques. The quicker a question is answered or instructions relayed to men in the field, the smoother will be the overall construction operation. Delays are always costly, and becoming more so with progressive wage increases.

It takes considerable time-consuming foot-slogging for a key man to make his normal rounds, or emer-

gency trips, on modern sprawling building projects or high-rise structures. And a lot of dead mileage is rolled up between headquarters and various projects. That is, unless the contracting takes full advantage of modern job communication facilities.

Wherever possible, tools and equipment have been put on wheels. Now, contractors are putting wheels under their key field personnel. Motor scooters, bicycles and small trucks are being used to get field supervisors to trouble points in a hurry.

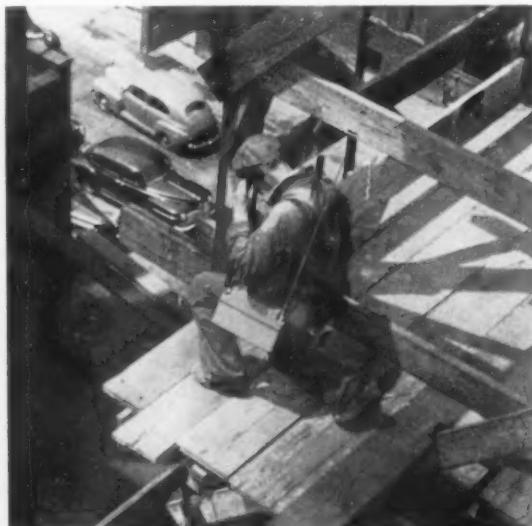
Backtracking seems almost in-

evitable, even with scooters and construction lifts. Workmen need an answer to a problem that has just arisen; go looking for the "boss." Change orders come through that must be relayed to men in the affected areas. To handle these problems expediently, contractors are resorting to construction intercom systems, conventional and sound-powered telephones, and, more recently, two-way radio systems.

Two-way mobile radio has been used by contractors for a number of years, primarily as communication between home office and roving



SOUND-POWERED TELEPHONE permits electrician checking relay operation to immediately report findings to mechanic at central control board 14 floors below. Telephone unit is completely portable and is self-powered.



2-WAY RADIOPHONE cuts communication time on construction projects to absolute minimum. Here, mechanic several floors up gets an answer from superintendent at ground level and is back to work in minutes.



SUPERVISOR CONTACTS office via 2-way mobile radio while enroute from one job to another; gives and receives instructions; saves considerable backtracking.

truck crews or supervisors. Licensing was under the Federal Communications Commission's Citizens Band service and equipment was generally limited to the mobile (truck) type. Some contractors, licensed under the Low Power Industrial service, have been using two-way radio for on-the-job communications using portable "walkie-talkie" type equipment. However, transmitter power output for the LPI system is restricted to 3 watts, barely adequate to cover a reasonable construction area.

Recent licensing changes of the FCC have liberalized the use of

2-way radio so any legitimate business can take full advantage of its benefits. Last August, the Federal Communications Commission established the Business Radio service providing a great number of channels for 2-way radio with frequencies available in all areas of the land mobile spectrum. Low or high power portable equipment can be used and licensing is relatively simple. This system is ideal for the electrical contractor. He can put a base station in his company headquarters, mobile units in his trucks and supervisors' cars, and portable 2-way units on the construction

sites. With it, he could have instant communication between all persons—office, trucks, and job site.

Just on the market, is a transistorized, pocket-size 2-way radio for use on smaller construction projects (limited to a reasonable amount of power output). Units can be clipped on a mechanic's or supervisor's belt.

One factor is clearly evident. There is no apparent need for "lost" or "wasted" time due to poor or disrupted job communications. Equipment is available for instant voice communication and enterprising contractors are using it to best advantage.



NEWEST ADDITION to 2-way radio communication is this light-weight pocket set consisting of clip-on belt receiver and small transmitter operating on regular 2-way mobile frequencies.



MOTOR SCOOTER speeds electrical superintendent on his rounds at sprawling shopping center project; saves time, money and leg-weary hiking.



POLAROID LAND CAMERAS, featuring 60-second prints, find extensive use on construction projects to chronicle installation problems, structural conditions and general job progress; provide a means of rapid visual communication.



Portable Instruments

- Ammeters
- Circuit analyzers
- Continuity testers
- Demand meters
- Fluorescent unit testers
- Footcandle meters
- Frequency meters
- Graphic meters—various types
- Ground detectors and locators
- Ground resistance testers
- High potential testing units
- Insulation testers
- Ohmmeters
- Oscillographs
- Phase sequence indicators
- Power factor meters

TOOL CHECK LIST

- Tachometers
- Transformer oil testers
- Voltage testers
- Stroboscopes
- Wattmeters
- Blowers and vacuum cleaners
- Communication equipment—see list in previous section. Personnel radio paging system—used in buildings with built-in loop antennae.
- Fixture washing equipment
- Maintenance control boards—for supervisors' office
- Record equipment—data file cards for feeders, branch circuits, transformers, switchgear, panels, controls, motors, etc.
- Scaffolds and ladders—see list in previous section.
- Tools—see lists in previous sections for applicable items.

COST-CUTTING JOB MECHANIZATION

TOOLS FOR MAINTENANCE

EVERY electrical system requires some degree of maintenance to keep equipment and facilities operating at their designed efficiency. Some components demand more frequent attention than others. For example: oil filled transformers,

circuit breakers, switches, contacts, motors, lamps and lighting accessories, relays and other moving parts subjected to electrical or physical wear are more apt to cause trouble than conductors and similar components. All parts of a system

should be checked periodically to detect and assess any abnormal component deterioration in time to make necessary corrections before an actual breakdown causes costly production shutdown. Such a program is termed Preventive Maintenance and is the key to efficient plant operation.

A well organized, well executed maintenance program represents a substantial investment in trained personnel, records, test equipment and repair facilities. However, when compared to possible production and equipment losses, preventive maintenance is low-cost insurance against expensive, unexpected plant shutdowns. Field experience has proved this repeatedly.

Whether maintenance is done by a plant (or building) electrical department, contractor, or specialized electrical service firm, depends on the economics involved in each individual case. Plant departments, like outside contractors, must sell electrical maintenance programs on the basis of tangible returns on



HI-POT TEST is applied to check high-voltage underground cable replacement in switchgear cubicle. Portable unit is effective maintenance tool.



PORTABLE GROUND DETECTOR locates electrical ground faults on ungrounded circuits without power shut-down. Unit sends low-frequency signal over cables. Hand signal receiver run along conduit gives pulsating meter reading until fault point is reached.

management's investment. Most plants and commercial buildings maintain their own maintenance departments. Some have found it more economical to "contract out" all or part of their electrical maintenance. Others are viewing this latter approach with cautious interest. The trend to "outside" maintenance is evident—although the swing at present is somewhat gradual.

Perhaps the most significant

shift to "contract maintenance" is in the lighting field. Normal lamp depreciation can reduce lumen output of a lighting system as much as 30%; accumulated dust and dirt can cut light output from 20% to 30%; low voltage can cause up to 20% light loss; and some plants lacking adequate maintenance have experienced up to 12% light loss due to lamp burnouts. Realizing that production efficiency depends on efficient lighting, management

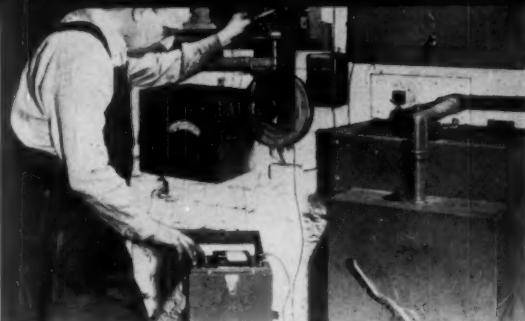
in general is overcoming these deficiencies by subscribing to a realistic maintenance program including group replacement (at about 80% rated lamp life) of lamps.

Many plant and building owners have turned their lighting maintenance problems over to contractor specialists who have equipment and techniques to do a complete job. On a regular scheduled basis, these firms check the lighting system, wash luminaires, furnish and in-

TYPES OF MAINTENANCE EQUIPMENT

Used for Lighting Servicing

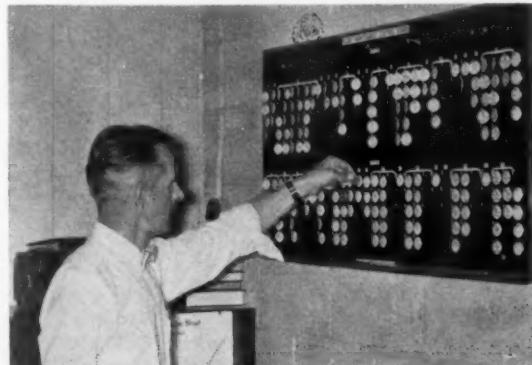
Equipment	Mounting Height (Feet)			
	To 12	12-18	18-30	Over 30
Catwalk (Or Truss)			x	x
Crane (Where Available)			x	x
Crows-Nest Ladder			x	
Disconnecting Hanger	x	x	x	
Portable Maintenance Platform	x	x		
Relamping Bridge			x	x
Step Ladder	x			
Straight Ladder		x		
Telescoping Platform Tower		x	x	



MECHANIC CHECKS insulation resistance of cables terminating in switch box. Selector switch transforms instrument into handy voltmeter. Can be used on motors and other equipment.



Fixture Washer on trailer was developed by lighting maintenance contractor to mechanize fixture cleaning phase of his contract maintenance service for office buildings, stores and industrial plants.



MAINTENANCE CONTROL BOARD with colored tags in chief electrician's office gives visual at-a-glance record of electrical equipment loads, changes and repairs in process. System effectively prevents overloading circuits.



AERIAL TOWER with dual crow's nests raises maintenance personnel to work area without interrupting plant operations; can boom out over obstructions; has control levers in crow's nest.



FIXTURE REPLACEMENT or maintenance is a one-man operation with use of adjustable fixture hoist which holds unit at any desired height. Mechanic can move hoist and ladder with relative ease.



RADIO PAGER clipped on mechanic's belt (arrow) speeds "in-plant" maintenance operations by providing instant one-way voice communication in buildings equipped with inside loop antennae.



WALKIE-TALKIE two-way radiophone permits instant communication between electrician at control board (left) and his associate checking motor trouble in another part of the plant.



POCKET-SIZE clip-on ammeter is a handy tool for quickly checking circuit loading at distribution panel breakers.

stall lamps, replace ballasts and make miscellaneous repairs. Management's only responsibility is to pay the bill. Monthly charges for this type of service range from as little as \$3 to as much as \$900. Average charges for offices and stores reportedly range from \$15 to \$50 per month, depending on work required.

Whether a plant crew or an outside firm does the electrical maintenance work, trained personnel, experience know-how, adequate equipment and proper "tools" are prerequisites to an efficient program. Instruments and established

test procedures are necessary to diagnose the existing condition of system components. Adequate records are needed to compare test results, establish inspection schedules, chart deterioration and determine when repairs should be made.

In addition to a normal complement of instruments for test purposes, maintenance personnel must be provided with the proper materials and tools to do an effective job. Many of the tools listed in previous sections can be used for maintenance chores. Selection varies with the work involved. Particularly adaptable are the variety

of scaffolds, ladders and aerial equipment for overhead work; also transportation and voice communication equipment available to minimize backtracking and time-consuming searching for and relaying of instructions to maintenance personnel throughout an area.

Maintenance tools and methods are many and varied. Effective combinations are developed to fit specific situations, solve specific problems. Some are illustrated in the attendant photographs. The ultimate goal—as in construction work—is to do a better job, in less time, at a reasonable cost.

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prismatic
at a
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price

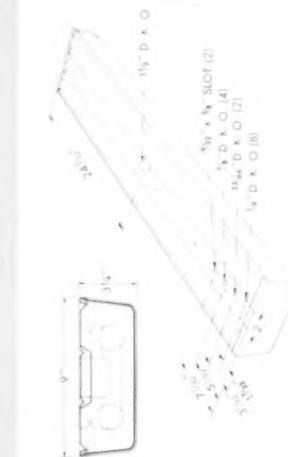
Below: Actual size photograph of clear plastic lens.

the
wonderful
WAKEFIELD®

prismatic

TRADE MARK

*has rocketed to success . . . hailed by contractors
and users everywhere . . . because it's so beautiful, so practical,
so easy to install and so very, very low priced*



Catalog Number	No. of Lamps	Description	Std. Wt.-Lbs	Pkg. Pkd.	Upgradd	Quan
R 214	2-40112/RS	Wakefield	16	14	1	
		Prismatic	30	28	2	

If your customer needs approximately 50 footcandles, install one Prismatic for every 40 square feet of area. Suggest to your customer that he paint his ceiling white and his walls a light color.



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Practical Methods

Office Lobby Relighting Paces Modernization Trend

MODERNIZATION

When lighting fixtures in a utility office become obsolete, and intensities drop below standards generally being recommended by company consultants for adoption by others, it's time to "practice what you preach" and think about modernization. That is the attitude of the Los Angeles Department of Water & Power. So, although existing lighting and the general environment of their San Pedro branch office was still "adequate" for normal business operations, it was decided to set a public example

of progressiveness by "up-dating" their facilities. Among other details, this decision to modernize contemplated lowering the high lobby ceiling from 20 to 11 ft and installing new fixtures.

Like many other companies, however, the budget couldn't be overstrained in the process. Therefore it was decided to combine lowering of the ceiling with the relighting proposal, thereby effectively reducing the pro-rated investment in each of these two desirable objectives. This decision naturally dictated a suspended luminous ceiling.

And, as indicated by the accompanying photos, the transition achieved the desired results.

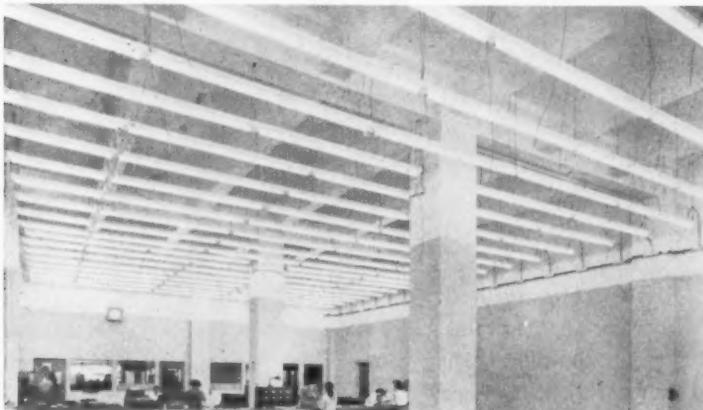
In detail, the installation consists of 89 8-ft standard cool-white lamps supported by 16-ft tandem-lamp channels, each 16-ft section being wired with a single 2-lamp ballast. Channels were installed end-to-end in continuous rows on 3-ft centers, 3½ ft above the level of the suspended corrugated vinyl panels, and row ends were evened-out by installing 22 4-ft lamps, as required.

Although a warm-white environment was desired, it was decided to install cool-white lamps on the assumption that the desired color would result when modified by the pigmentation of the vinyl panels and the 85% RF eggshell-white enamel paint used in the plenum chamber. This assumption proved correct, and further warmth was obtained by judiciously selecting pleasing tints for wall surfaces.

Another consideration was the use of acoustical baffles as related components in the ceiling installation, but this additional feature was omitted inasmuch as the existing noise level in the office was no problem at the time.

In installing the ceiling, wire hangers were equipped with turnbuckles so that separate fixture runs and ceiling channels could be leveled easily. Hooks and disconnect plugs were also provided so that, if it became necessary to replace a ballast or other component in a fixture, the entire unit could be removed and a spare immediately installed to minimize replacement times. This entire installation was performed by electricians of the department's repair section.

With all lamps installed, but before the vinyl ceiling had been placed in position, average foot-candle values at desk levels were 110. Installation of the corrugated panels reduced this value to an average of 85 and, after four months of service, the maintained lighting intensity leveled out around 70 fc. At this time it was also found that lighting on vertical faces of files and shelves was 40 footcandles, while brightness values of the translucent vinyl ceiling panels were between 85 and 90 foot-lamberts. These values proved quite satisfactory.



WITH CHANNELS IN PLACE but before vinyl ceiling had been installed, inspection showed details of simple mounting plan; 16-ft tandem-lamp channels being placed end-to-end with rows on 3 ft centers, and with 4 ft sections added to even out the rows, as required. Average lighting intensity at desk level at this stage was 110-fc.



COMPLETED INSTALLATION shows effective lowering of the 20-ft ceiling height and general improvement in the appearance of the lobby. Initial lighting with corrugated suspended ceiling in place was 85-fc, with final maintained level approximating 70. Installation provided impetus for neighboring merchants to follow this modernization program.

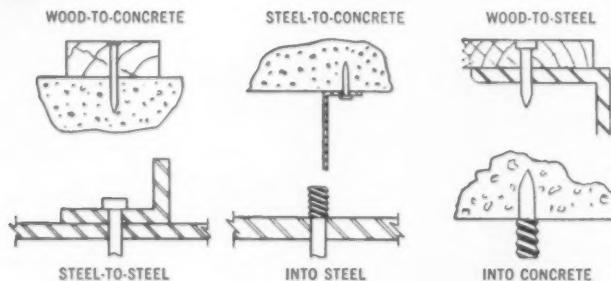
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Threaded studs, drive pins, eye pins—over 100 specialized fasteners team with ten types of powder charges to assure you of just the right holding power for each job. It will pay you to get more details. Your Ramset dealer is listed in the Yellow Pages under tools...call him today!

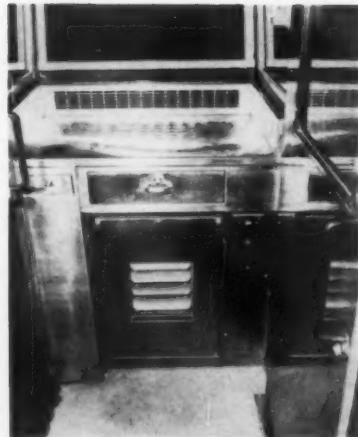


In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Sel® hammer-in tools for light fastening, and Ringblaster® heavy-duty kiln gun.

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Turnpike Toll Booths Heated Electrically

ELECTRIC HEAT

Kansas Turnpike toll booths have been supplied with 14 electric unit heaters rated at 7½ kw each. They have been installed beneath the booth's change desks, completely out of the way of the attendant.

Adjustable air deflection louvers permit the attendants to adjust the warm air flow to suit personal requirements. The units are equipped with a manual reset thermal-cutout switch and built-in fan thermostat. Operation of the fan is delayed until the heating element reaches desired temperature. Fan operation continues after turning off heating element until the temperature of the element drops below warming level, thus assuring that only warm air will be circulated at all times.

Heater elements operate at 480 volts, 3-phase; fan motor is single phase, 115 volts.

Contractor was Plaza Electric Co., Kansas City.

Neon Lamps for Aircraft Clearance Markers

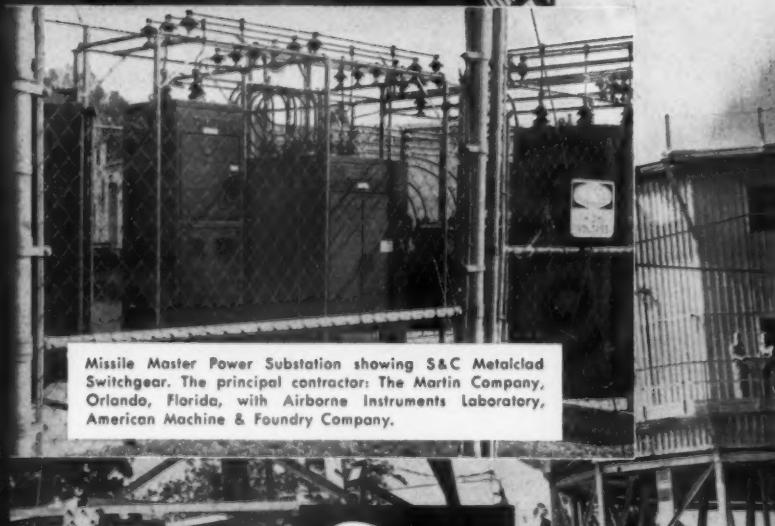
LIGHTING

A unique system of aircraft clearance lighting has been installed on the buildings of Hughes Aircraft Company at El Segundo, Calif. This division of the Hughes Company is adjacent to the Los Angeles International Airport where a control tower operator courteously notifies the occupants of surrounding buildings when one or more of their clearance markers is inoperative. Difficulty in relamping and maintaining the equipment, due to inaccessibility, prompted the adoption of a neon tube lamp devel-

For the U.S. Army Missile Master—

Where Reliability is a Command:-

**S&C Metalclad
Switchgear is
used on the
primary power
supply**



Missile Master Power Substation showing S&C Metalclad Switchgear. The principal contractor: The Martin Company, Orlando, Florida, with Airborne Instruments Laboratory, American Machine & Foundry Company.

At Fort George G. Meade, Maryland, this vital electronic installation collects information on the location of aircraft, presents this information on displays for decision, and then distributes selected data to NIKE missile batteries in a large defense area. The high-voltage power supply for the radar and electronic devices uses S&C Metalclad Switchgear for primary protection and switching.

Specified as part of this ultra-reliable nerve center of the Nation's defense are S&C Metalclad Switchgear units, using Power Fuses and Load Interrupters. See inset, left.

Such installations will be used in many areas throughout the United States, where NIKE installations protect population and industrial centers.

For further information about S&C Metalclad Switchgear, write to S&C Electric Company, 4433 Ravenswood, Chicago 40, Ill.

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Since 1910



METALCLAD SWITCHGEAR



80 miles of Conduit... 90,000 Bends and a LIDSEEN "Chicago" Bender used on Complex Electrical System

Lidseen "Chicago" Pipe Bender is right on the job with Metrick Electric Company of Chicago. Photo above shows skilled electricians working on the complex electrical system of the new \$4,000,000 Glenbard East High School in Lombard, Illinois. **The Lidseen "Chicago" Bender has traveled with Metrick Electric for over 15 years** and proved to be a real on-the-job tool . . . it's rugged, has ideal working height, gives accurate bends every time . . . no strain, slipping or loose parts to worry about. Ask the electrician who is using one; he will tell you it's the finest tool available and at a price that is eminently reasonable.

BENDING CIRCLES: INSIDE RADIUS

No. 1	No. 11
1/2" conduit or pipe	2"
5/8" conduit or pipe	4 1/4"
1" conduit or pipe	5 3/4"
1 1/4" conduit or pipe	7 1/4"
1 1/2" conduit or pipe	8 3/4"

Illustrated: No. 1 for bending 1/2", 5/8" and 1" rigid conduit

Write for FREE
illustrated Folder on
How to Bend Conduit



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NEON LAMPS in clearance markers have 5-year life, low wattage, and are burned continuously.

oped at our request by Nelson-Price Incorporated of South Pasadena, Calif. The expected life of the new neon lamp is five years when burned continuously. This, contrasted with the short time burning hours of the incandescent lamps previously used, would be reason enough for the replacement. Troubles with inaccessibility for relamping, and the problems of renewal, adjustments, periodic inspection, and cleaning of photocells, time clocks and switching equipment necessary for the operation and control of the ordinary system, have been practically eliminated. The increased reliability is evidenced by the fact that the installation has been in operation more than a year without maintenance, whereas, the average life of the incandescent lamp of the previous system was 60 days.

The process of converting the old to the new was scheduled in accordance with the following procedure: The new neon element was set into the standard existing fixture receptacle base. Except for the installation of a ballast transformer in the line at each location, no other changes in conduit distribution were necessary. All control equipment was disconnected and removed and circuits were directly connected to emergency panel circuits.

Each lamp unit of the new system draws 25 watts. With the low wattage drain, the overall consumption is no more than with the incandescent lamps on intermittent operation. Because the useful effective life is lengthened instead of shortened by continuous burning, the necessity of any kind of photoelectric or time control relay is eliminated; thus, maintenance is reduced and reliability is increased at the same time.

There is an additional advantage

ASCO low voltage Remote Control Switches

decrease installation costs

increase safety, permissible line run

ASCO Remote Control Switches equipped with *low voltage control* are suitable for 24 volt A-C control by push button, time switches, relays or other control methods.

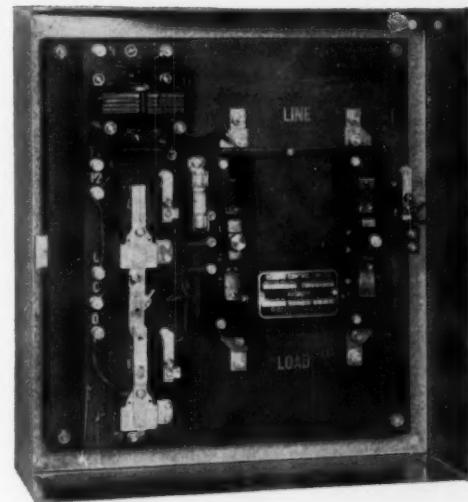
ADVANTAGES

- **ADAPTABLE LOW VOLTAGE RELAY PANEL:** Can be mounted separately from the Bulletin 920 Remote Control Switch. Relay panel includes low voltage control relays with a stepdown transformer.
- **REDUCTION IN COST OF INITIAL INSTALLATION:** Control equipment can be connected through small wires — no BX or other large cable required. Control components such as push buttons can be inexpensive units: no conduit boxes are needed.
- **SAFETY:** Lower voltages provide increased safety for personnel. For schools or any installations where control stations are accessible to the public, the safety advantage of low voltage control is apparent.
- **ASCO "PACKAGE UNIT" REQUIRES NO EXTERNAL RELAY OR FUSE BOX:** The Remote Control Switch, Relay, Transformer and Fuse — all the items needed for low voltage control — are on one compact panel.
- **INCREASE IN PERMISSIBLE LINE RUN**

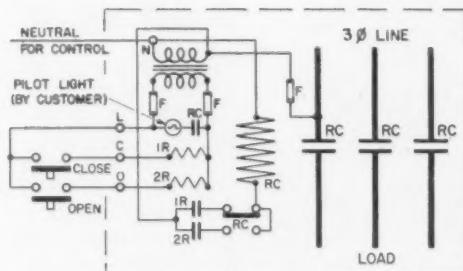
CONSTRUCTION AND OPERATION

Complete panel consists of a Bulletin 920 Switch with fuse adapter, auxiliary contact, and low voltage relay panel. In Circuit Diagram, control is shown from momentary contact control stations, using two normally open momentary contact buttons, one for closing and one for opening. Note that the push buttons are on the low voltage control circuit. Control wires can be #18 for a maximum distance between control station and switch of 500 feet; maximum line run for #14 wire is 1300 feet.

Additional openings and closing buttons can be connected in parallel with buttons shown.



Catalog No. 238SIC, 30 Ampere Bulletin 920
Remote Control Switch with Low Voltage Control.



Elementary Wiring Diagram—Bulletin 920-238
Remote Control Switch for 24 Volt Low Voltage Control.

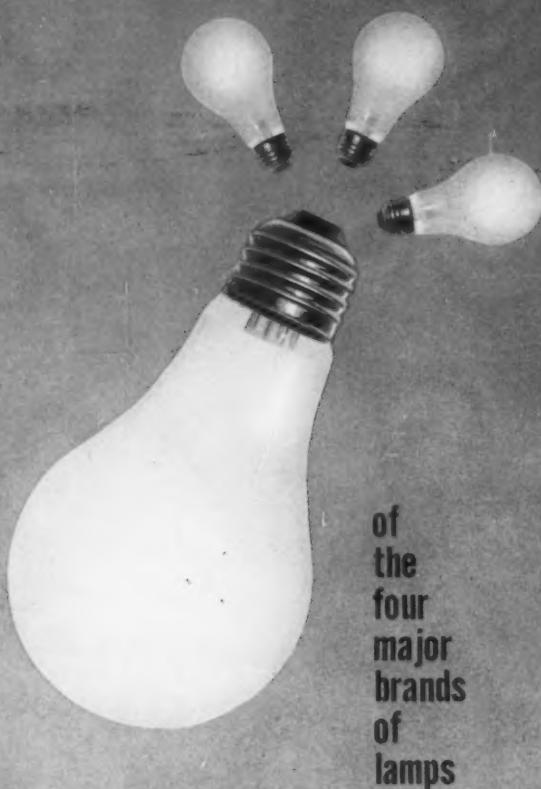
FOR COMPLETE INFORMATION, WRITE FOR BULLETIN 920-238 — OR HAVE THE ASCO ENGINEER CALL.

Automatic Switch Co.

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AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

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Millions of lamps a year . . . one plant standard of quality control . . . Champion has one aim in mind . . . lamps that convert electric current into light at lowest overall cost.

CHAMPION LAMP WORKS, Lynn, Mass.



in the fact that the wavelength of energy emitted from the neon lamp is predominantly in the red band of the spectrum. This energy is only slightly affected by the fixture glass, whereas, the broad spectral distribution of energy from the filament source is largely filtered out by the ruby glass. The overall result is a deep red of exceptional brilliance that is more noticeable and penetrating in all types of weather.

From A. H. Potter, chief electrical engineer, Hughes Aircraft Co., El Segundo, Calif.

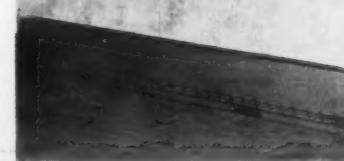
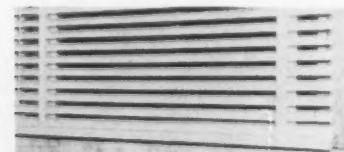
Hotel Modernizes With Electric Heat

ELECTRIC HEAT

Electric baseboard heaters have solved the problem of supplying heat to replace that previously furnished by a deteriorating, inadequate old boiler in the 4-story Otis Hotel, Spokane, Wash. A review of all factors involved indicated that electric heat could be installed at less cost than a new boiler installation, eliminating at the same time many maintenance and redecorating problems.

Remodeling of the hotel to provide apartment units began two years ago. Old radiators are being replaced by baseboard units as the remodeling progresses. Individual control within the apartments, not previously available, was considered essential for the new more permanent occupants.

Underground service to hotel is 120/208 volts, 3-phase, 4-wire. Johnson Electric, of Spokane, is handling the installation.



BASEBOARD HEATERS installed beneath windows of newly remodeled hotel apartments have improved appearance considerably, replacing unsightly steam radiators.



What do you look for

FIRST in

Power Roof Ventilators?

IS IT CAPACITY?

Look first to Ilg for propeller fan power roof ventilators and you'll find the size that's rated for your needs. No reason to put up with either *more* or *less* ventilation than you want.

Ilg offers 11 different sizes for exhausting as little as 87 c.f.m. . . . as much as 21,100 c.f.m.—at static pressures from 0" to $\frac{1}{8}$ ".

Lifetime, low-in-height aluminum housing . . . solid, heavy-gauge construction . . . withstand weather and wind. Leakproof.

IS IT PERFORMANCE?

Look first to Ilg for quiet, vibration-free performance. Ilg-built direct-connected, patented "Q" Type fan wheel and totally enclosed, constant and 2-speed motors assure smooth flow of power. No belt noise or slippage. Little friction loss. Low bearing wear.

Low-starting torque subjects permanent-split capacitor single-phase motors and 3-phase motors to less initial shock . . . lengthens motor life.

Fan design passes air over blade smoothly and quietly, eliminates noisy turbulence. Ilg "One-Name-Plate" pledge of performance covers both the dynamically balanced fan wheel and permanently lubricated motor.

For further information, write for Bulletin 2302.



ILG ELECTRIC VENTILATING COMPANY

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Offices in 57 Principal Cities

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► Dallas' NEW SOUTHLAND CENTER

**supplied with
12,000 kva
of electricity**

Served by six Wagner Underground Network

Transformers Dallas' fabulous new Southland Center consists of the 42-story Southland Life Tower, tallest building west of the Mississippi, and the 600-room Sheraton-Dallas Hotel. A "City within a City," the Southland Center is an enormous consumer of electric power. For example, there is a 6,450 ton electrically-driven air conditioning system—fourth largest in the world!

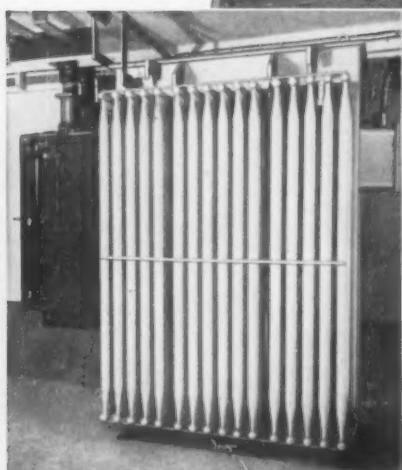
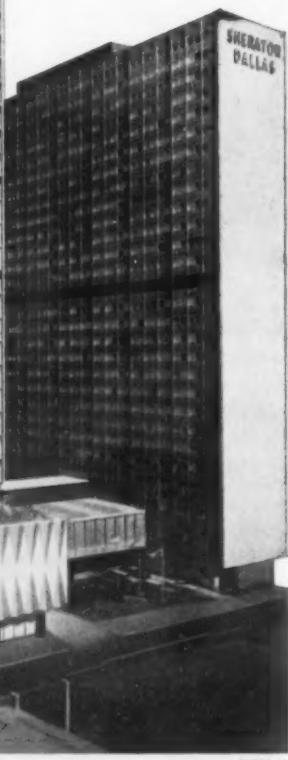
Dallas Power and Light Company, who supplies this power, has installed six 2,000 kva underground network transformers in the basement of the building to assure continuous electrical service to the Center. The transformers were supplied by Wagner.

Wagner Network Transformers are built for installations of this type. They have a low noise level . . . they are small in size to fit in close quarters, and now have a compact switch and panel radiators for smoother contour and easier maintenance.

Wagner makes a complete range of transformers for industrial and power company needs. Consult your nearby Wagner Sales Engineer about your power distribution program. There are Wagner branches in 32 principal cities.



Southland Center has 296 miles of electrical wiring . . . 15,800 lighting fixtures . . . 28 elevators . . . 8 escalators and an all-electric company cafeteria.



WT59-11
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ELECTRICAL . . . AUTOMOTIVE

Wagner Electric Corporation

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BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Motor Shops

Portable Coil Racks Boost Shop Efficiency

Mass production techniques for specific operations are being adapted by an increasingly larger number of motor repair shops. One midwest shop with an eye to increased operating efficiency and better customer service, is Electrical Engineering & Equipment Company, Des Moines, Iowa. Here, every phase of shop operation is carefully analyzed. Mechanics with long repair experience are trained to spot areas where improvements can be made; are encouraged to develop and apply their own time-saving ideas.

Coil handling in the large motor repair department is one of the component operations where this training has paid off. To speed the flow of coils from spreader to bake oven, A. B. Hartman designed and constructed a series of four-arm portable racks that rotate on a pedestal bar and can be moved from pedestal to pedestal when desired. Loaded racks can be lifted off the stands and dipped into the varnish tank for coil impregnation.

The four arms of each rack are 13½-in. lengths of ¼ in. by 1 in. flat steel welded (edge-up) to a 6-in. sleeve of 1½-in. pipe at diametrically opposite points. A 2½ in. length of ¼ in. steel rod on the end of each arm provides a retainer flange to



PORTABLE COIL RACK rotates on pedestal base. Coils taped by machine in background are placed on empty rack. When rack is loaded, it can be moved to dip tank. Machine operator takes coils from duplicate rack positioned at left.



LOADED RACK is raised from dip tank after coils have been impregnated with insulating varnish. Rack can be placed on storage pedestal to await baking and transfer to assembly area.



LIFTING EASE and free rotation are features of the rack design. Here, mechanic lifts varnish-covered rack from supporting pedestal. Note how coils can "nest" on rack arms.

keep coils from slipping off the rack. Reinforcing braces (1 in. by ¼ in. flat steel) between rack sleeves and arms assure rigid support of coil weight. Top of the sleeve is capped so the rack can rest on and rotate about a 1-in. dia. steel pedestal supported by a 30-in. X-brace of 1½-in. angle iron. Racks are 36 ins. above floor level; have a 3½-in. high lifting hook fashioned from a U-shaped 1-in. bolt rod welded to the sides of the sleeve.

A number of racks are used to approach production-line flow in the coil department. An empty rack at the coil spreader is loaded as the coils come off the spreader. This rack is then moved to a pedestal at the left of the coil-taping machine.

An empty rack is at the right of the taping unit. The operator takes a coil from the left rack, tapes it and places it on the rack at the right. Loaded racks of taped coils are removed to the dip tank area where an electric hoist lowers them into the insulating varnish. After draining, the rack of impregnated coils can be placed on a storage pedestal to await baking and final transfer to the assembly department. In the interim, the cycle is repeated for other sets of coils.

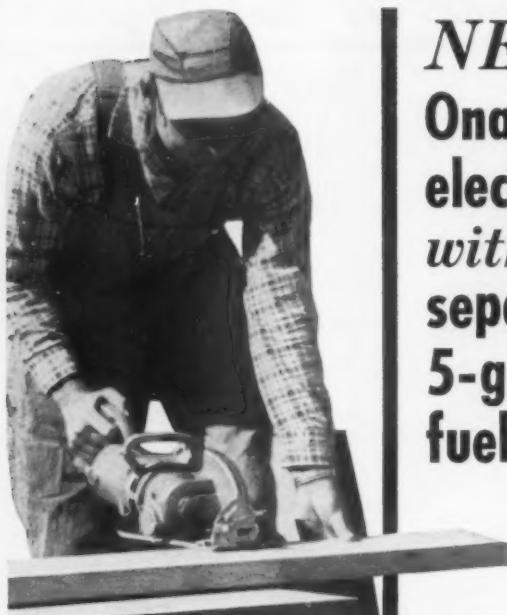
The advantages of this technique are most apparent when the shop is busy. Chances of a coil-handling "road-block" or slow-down are nil. Even when pressures are less demanding, mechanics like the speed and simplicity of moving coils from one operation to another.

Intercom Speaker Used To Detect Short Circuits

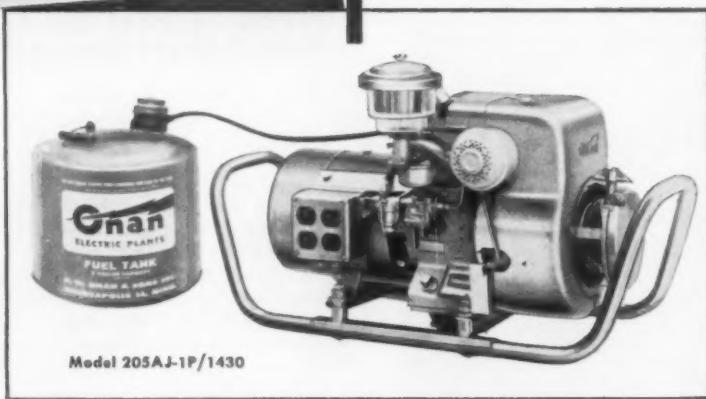
Use of an intercom speaker in connection with a growler takes the guesswork out of short circuit tests in the shop of Riles Armature Winding, Roanoke, Va., where mechanics can double-check by sound as well as by meter sight. With the growler providing induction current through the armature and with amplified sound variations emitted from the speaker when lead-probes are moved around the commutator, little doubt remains in the mind of the tester as to whether the armature is shorted, cleared or closed.



LEAD-PROBES from speaker are moved around the commutator while an armature is cradled on the growler. Variations in sound are amplified to inform mechanic of short circuits.



NEW! Onan portable electric plant with separate 5-gallon fuel tank!



Model 205AJ-1P/1430

Special 2,500-watt contractor's model combines light weight with dependability

Supplies 2,500-watts A.C. . . . enough for a crew of three men using electric tools . . . yet it weighs only 140 pounds!

New separate fuel tank holds $2\frac{1}{2}$ times as much as regular mounted tank, saves refueling time. Fuel line is quickly detachable. You can move the plant without carrying along heavy fuel.

Ruggedly-built . . . quick starting

Powered by a dependable Onan 4-cycle, single-cylinder, air-cooled engine. Drip-proof, all-climate Onan generator is directly connected making a compact, rigid, smooth-running power package. No belts or couplings to cause trouble. Aluminum carrying frame, 4 plug-in outlet box, recoil starter and separate fuel tank are standard. Choice of 115, 230, or 115/230 voltages.

Many more models—500 to 200,000 watts. Call the Onan distributor listed in your phone book or write—

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Tilt Racks Simplify Lead-Wire Reel Storage

Efficient shop procedures require that accessibility and payout ease be prime considerations when storing motor lead-wire reels. When specific sizes are needed for a rewind job, the mechanic should be able to pull out and cut off the required lengths in minimum time. To accomplish this, Herbert Peterson of Electrical Engineering & Equipment Co., Des Moines, Iowa, designed and built a series of floor racks that keep the 24-in. dia. reels a few inches above floor level for easy payout. Hinged construction permits the racks to tilt forward so the reels can be rolled out, for replacement or use elsewhere, without lifting the units.

The tilt-racks are built in eight sections spotted back-to-back in two rows of four sections each. A long board on a stationary rack between rows holds card frames identifying wire size on each of the 32 reels (16 per row) so stored. Because of weight considerations, each rack section accommodates only four reels. Thus, any mechanic in the shop can, with the aid of a lever bar, tilt any loaded section with comparative ease.

A typical rack section is 42 ins. long, 14 $\frac{1}{2}$ ins. wide, and has an inclined support bar which keeps the axis of the reels about 15 $\frac{1}{2}$ ins. from the floor. The two sides and back of the rectangular rack base are made of 1 $\frac{1}{2}$ -in. angle iron; the front, or hinged bar, is 1 $\frac{1}{2}$ in. by $\frac{1}{4}$ in. flat steel equipped with four T-hinges securely fastened to the floor. The inclined reel support is a length of 1 $\frac{1}{2}$ -in. angle iron with an open-top socket to seat the cross-bar on which the reels rotate. Socket for the tilt-bar is an 8-in. upright of 1-in. pipe welded to one back corner of the base frame.



DUAL ROW of sectionalized racks stores 32 reels of motor lead-wire for easy access and payout. Rack sections tilt forward for reel removal or replacement.

CLICK!
IT'S A DRILL!

CLICK!

IT'S A
SCREWDRIVER
AND NUT RUNNER!

CLICK! IT'S REVERSIBLE
FOR REMOVAL, TOO!

Now, a powerful drill plus a screwdriver both in one tool...the NEW B&D 3/8" SCRUDRILL



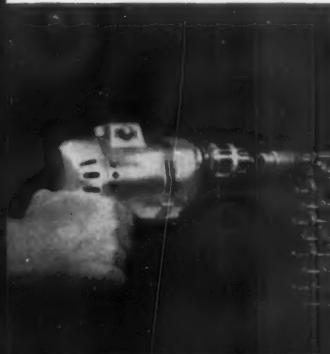
DRILL in metal or wood. Powerful B&D motor gives you full $\frac{3}{8}$ " capacity in steel, $\frac{3}{4}$ " in wood.



DRIVE screws, nuts or bolts with same tool. Handles #10 x 1 $\frac{1}{2}$ " wood screws #12 self-tapping.

REMOVE as many as 60 screws, nuts and bolts in 60 seconds. Just flip the reversing switch.

REVERSING switch is piggy-back mounted for convenience. You can flip it with your thumb.



SPEED WORK

with this lightweight 2 in 1 tool.

Imagine! A simple turn of the wrist and you switch from drill to screwdriver. A flip of a switch and you're removing screws, nuts and bolts. Remove a bolt, oversize the hole, run a new bolt—as easy and fast as 1-2-3 and all with the same tool, your new Black & Decker $\frac{3}{8}$ " Reversible Scrudrill!

For woodworking, electrical, plumbing jobs, boat work, general maintenance and many other jobs, try a B&D Reversible Scrudrill today.

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two new INTERCHANGEABLE trays for support of cables, wiring and tubing

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- ★ Steel or aluminum construction
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- ★ No sharp edges to damage cables
- ★ Complete interchangeability



Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

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PRODUCTS DIVISION

The GLOBE Company MANUFACTURERS SINCE 1914

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RACKS TILT forward on floor hinges for easy loading and unloading. Lever bar fits in pipe socket welded to back of base frame. Each rack section holds four 24-in. dia. reels.



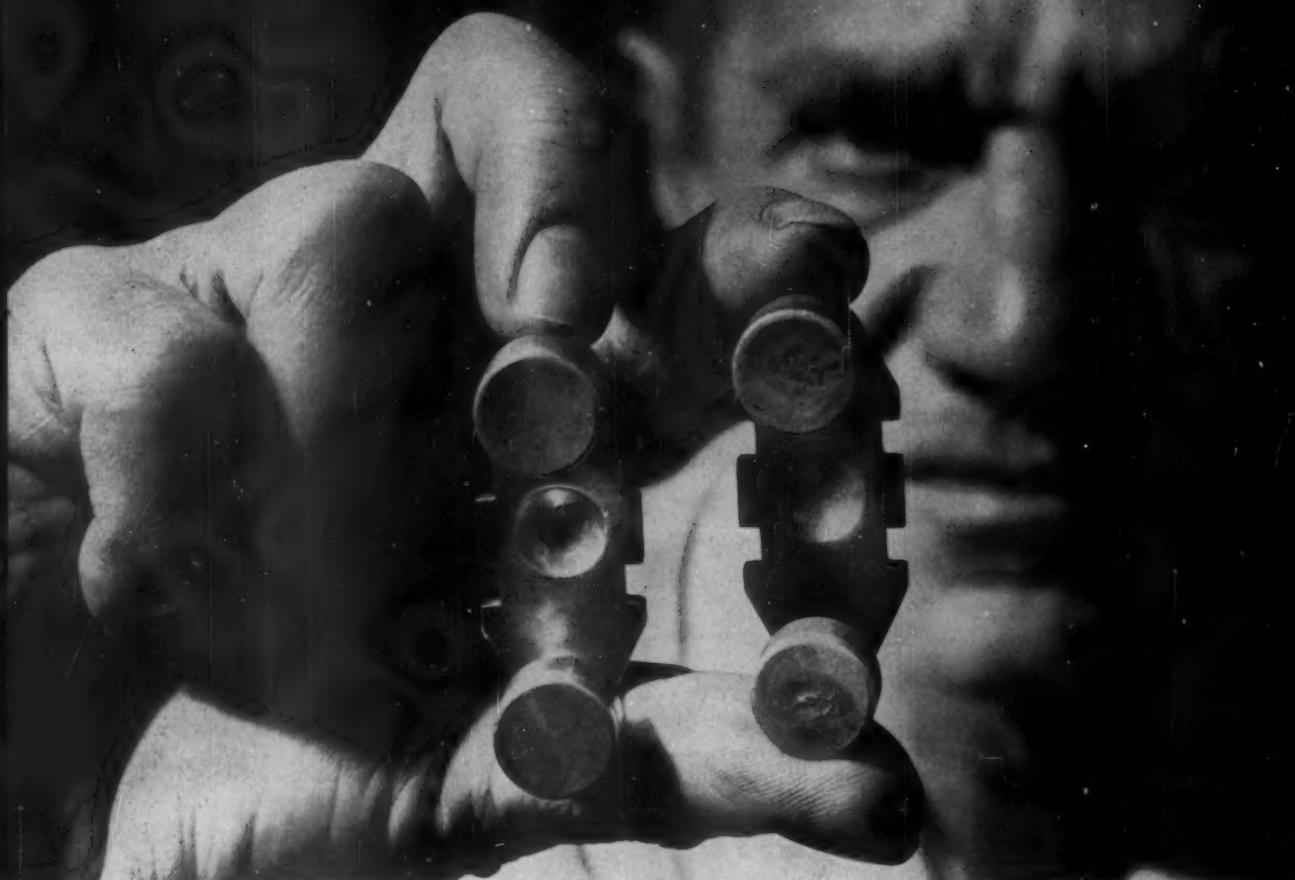
REELS ON FLOOR are disengaged from axle-socket of rack in "down" position; can be rolled elsewhere or replaced with new reels. No lifting is necessary to load and unload rack sections.

Unloading a rack is a relatively simple matter. The mechanic places the tilt-bar in the pipe socket and applies a forward pull near the top of the bar. Using this leverage to advantage, he tilts the hinged rack forward until the reels touch the floor and roll out to disengage the axle from the rack socket. The inclined reel support serves a dual purpose. In normal storage position, it places reel weight off "dead center" to keep the rack stationary. Once the reels pass "dead center" when the rack is tilted, their weight momentum complements the forward pull on the lever bar. Reverse pressure on the bar at this time acts as a braking force to keep the reels from "bouncing" on the floor.

Loading the rack is a converse operation. The tilted rack is positioned to seat the axle of the four reels. Then an upward thrust on the lever bar raises and moves the reels past the "dead center" point. Then the mechanic holds back on the lever to ease the loaded rack into its stationary position.

Shop mechanics report this reel storage technique works exceptionally well. Areas around the reels are always accessible for easy pay-out of lead-wire; reels can be removed or replaced without lifting.

HERE'S THE LOW-DOWN
ON STARTER UPKEEP...



Contact tips hold up "like new" after one year's service to keep your maintenance down

The unretouched photograph above shows two sets of contact tips from a Clark Type "CY" A-C Motor Starter. One set has seen a year of continuous hard service with frequently as many as 5,000 operations per hour. The other set is brand new — unused.

Which contact tips were actually in service for one year? The obvious, but not too obvious clue is the slight discoloration and minute pitting in the tips at right above.

But you can easily see for yourself that even after one year of steady operation these tips show very little evidence of wear. Their present condition will assure many more years of dependable service, free of maintenance.

The secret? Clark's exclusive "arc quenching" principle incorporating the use of strong, multi-turn magnetic blow-outs and double-break contacts.

The action of the magnetic field not

only forces the arc to rotate, moving it continually over contact surfaces, but tends to "quench" it at the same time. Result: Less wear on contact tips and fewer maintenance headaches.

There are many more good reasons why the Clark Type "CY" Starter is your best *preventive* maintenance buy. For complete details contact your nearest Clark Controller sales office or distributor. Or, write direct.

601

 **The
CLARK CONTROLLER**
Everything Under Control • 1146 E. 152nd St. • Cleveland 10, Ohio
IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO
Company



Photo courtesy of Western Electric Co.
Architects & Engineers: Lockwood Greene

This is PRACTICAL MAINTENANCE . . . WITH *Servisafe* POLES

In less than 10 minutes, this man will have finished replacing a burn-out and cleaning a luminaire. It's a fast, efficient, no sweat job. He is free from climbing hazards, and the lowered fixture is dead. In addition, his only "auxiliary" equipment is a detachable handleline!

The unique advantages of Thompson "Servisafe" Metal Poles assure year-round all-weather lighting maintenance at minimum cost. In fact, there is no easier, safer or more economical method of servicing pole-mounted luminaires.

FOR DETAILS AND PRICES, WRITE
FOR BULLETIN PWB-59.

8014-TE

THE THOMPSON ELECTRIC CO.
P. O. BOX 873-D, CLEVELAND 22, OHIO

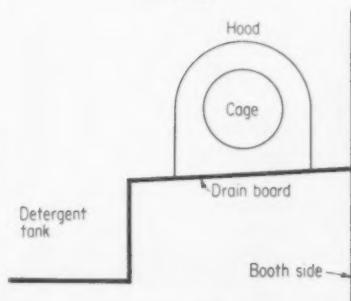
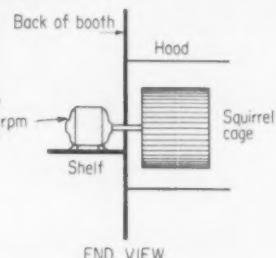


Blower Squirrel Cage Spin-Dries Oil Wicking

For shops who find it feasible to clean reusable oil wicking in motors, C. M. Gates, head of Iowa Service Company's motor repair department in Des Moines, has come up with an automatic drying device. It is a simple adaptation of a centrifugal blower squirrel cage as a spin-dryer.

Iowa Service mechanics took the squirrel cage (6-in. or 8-in. dia.) from a conventional centrifugal blower, put its shaft through an opening in the back wall of their metal cleaning booth (over a detergent tank), and connected it to a fractional horsepower motor ($\frac{1}{6}$ or $\frac{1}{4}$ hp, single phase, 1725 rpm) mounted on a shelf behind the booth. A sheet metal hood over the cage catches the excess detergent centrifugally wrung out of the wicking and directs it to the tilting drain board for return to the detergent tank.

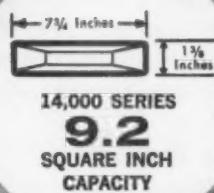
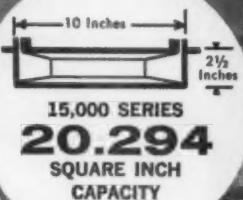
After being soaked in the detergent, the wicking is removed and hand squeezed and then flipped into the spinning cage. The combination of centrifugal force and air flow through the cage fins effectively removes any residual detergent in the wicking while the mechanic pursues his other cleaning chores. When the motor is turned off and the cage stopped, the dried wicking is removed.



SPIN DRYER for oil wicking uses squirrel cage of conventional centrifugal blower. End and front views show mounting arrangement in cleaning booth over detergent tank.



New from National Electric



POWER AHEAD

TWO NEW STANDARD-DESIGN HEADERDuct SYSTEMS NOW OFFER...



Selected for new \$45 million Kaiser Center, Oakland, Calif. NE systems proved flexible enough to meet unique construction requirements and tremendous telephone feeder system wiring load. Welton Becket & Associates, Architect and Consulting Engineers. Foothill Electric Company, Electrical Contractors.

LARGEST CAPACITY DUCT AVAILABLE

- Greatest wire capacity of any Headerduct provided in a standard design
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- Fast installation—easy fishing. Quick access to entire system
- Strongest service fittings of any system
- Attractive modernistic design of service fittings harmonizes with modern as well as traditional architecture
- Most complete line of telephone service fittings
- U/L listed for *all* approved cellular steel floors
- Application engineering available

For complete information, write: National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.



New large capacity cross box for the 14,000 Series has 11 3/4 inch opening for access to cells. Adjustment for 2 3/8 to 2 3/4 inch concrete depth.

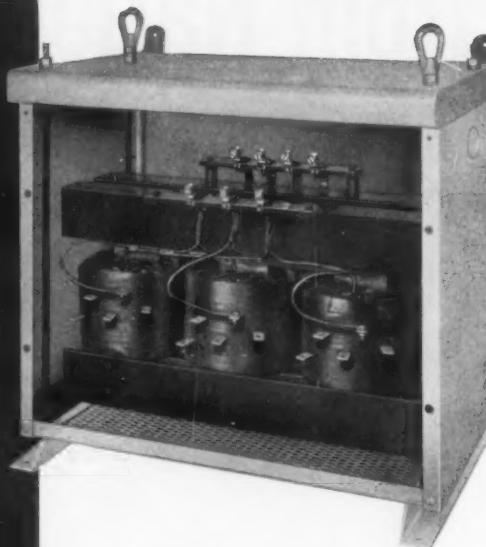
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PORTER

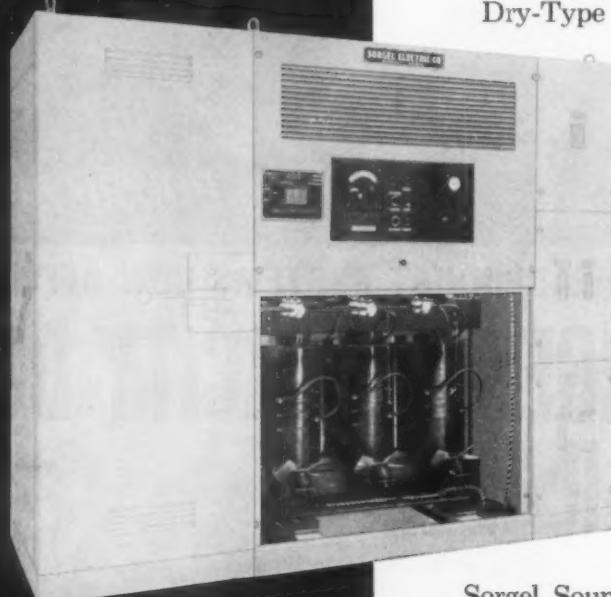
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an
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45 Kva 3-phase
transformer with taps.
Interchangeable wall
or floor mounting.
Front panel removed,
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150/200 Kva 3-phase
4160 volt to 480 volt
dry-type transformer with
temperature control system

To be specific . . . it's the transformer, or the heart of the substation, that counts! Yes, when the "inside" includes a Sorgel Sound-Rated Dry-Type Transformer, you are assured of . . .

- ✓ Extreme Quietness
- ✓ High Efficiency
- ✓ Overload Capacity
- ✓ Full Kva Plus
- ✓ Advanced Design
- ✓ Improved Safety and Protection
- ✓ Proved Reliability

*Leading the Industry with Over 40 Years
of Manufacturing Development*

Complete line for every purpose. Up to 10,000 kva, up to 15,000 volts. Also Special Transformers, Saturable Reactors, and Substations.

Sorgel Sound-Rated Dry-Type Transformers are the most practical to step down high distribution voltage to utilization voltage at load centers, in every type of building, and modernization projects.

Sales Engineers in Principal Cities.

Consult the classified section of your phone directory or write to the factory.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE
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New York 36, N. Y.

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The Editor
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330 West 42nd St.,
New York 36, N. Y.

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NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

USE THESE CARDS

● PRODUCT NEWS, PRODUCT BRIEFS:

Use first line of boxes. Insert item numbers of products on which more information is desired.

● CATALOGS, BULLETINS AND ENGINEERING DATA:

Use second line of boxes. Insert item numbers of literature desired.

● ADVERTISEMENTS:

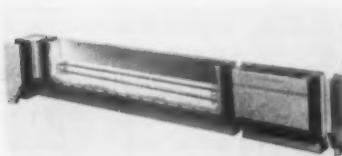
Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

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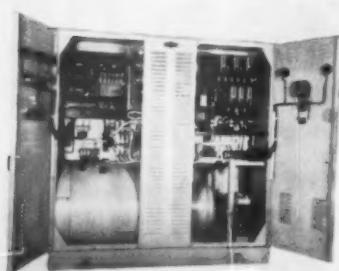
Product News



Electric Heating (1)

A new line of baseboard electric heating with a sealed Corox element is now available in 2-, 4-, or 6-ft sections. Heating capacity is 250 watts per linear foot. By using a 3-way airflow design, the surface temperature of the baseboard sections is kept low enough to touch. Room temperature can be maintained within two degrees of any desired temperature, from 55 to 85 degrees F, with a thermostat control section. Also included in the line are electrical outlet, corner end and blank sections. All sections are 7 ins. high by 2½ ins. deep and can be joined together to form a continuous unit. Can be installed in new construction or in existing rooms.

Westinghouse Electric Corp., Pittsburgh, Pa.



Motor-Generator Set (2)

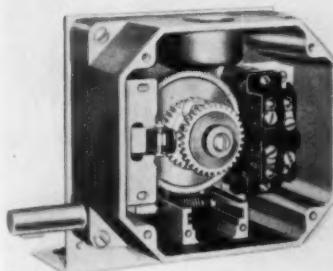
Completely housed frequency converting systems have been added to this line. Generator output is 40 kw, 50 kva, 120/208-volt, 3-phase, 6-wire, 400 cycles, 40-pole, 1200 rpm, revolving field type with static excitation, power to the rectifying unit being supplied from the motor input source. Generator is powered by a 440-volt, 80 hp, 3-phase, 6-pole, 60-cycle, 1200-rpm synchronous motor with rotating exciter. Motor and generator are mounted on a single shaft within a common frame with the motor exciter of the sleeve type and mounted on an extension of the main drive shaft.

Kato Engineering Co., Mankato, Minn.

Cable Support (3)

A raintight, enclosed cable support—"Type W"—designed for use as an intermediate support for cables in an outdoor, vertical conduit run. It can be used for one or more wires, in conduit sizes from 1 to 5 ins. Fittings are designed for use with all types of insulations at all voltages. Sleeves, furnished with the fittings, range in length from 12 to 18 ins. Standard finish is hot-dip galvanized.

O. Z. Electrical Manufacturing Co., Inc., Brooklyn 17, N. Y.



Switch (6)

A new model precision rotating shaft limit switch is available in six gear ratios from 40:1 to 1080:1, and when mechanically coupled to driving equipment, eliminates the need for two to four remotely located conventional limit switches. Limits are set by turning a screw. Rated at 600 volts maximum, the switch can be used as a pilot device for controlling ac or dc reversing starters or contactors that operate motors on machine tools, cranes, hoists, mechanical presses, conveyors, valves and other similar forward-reverse operations.

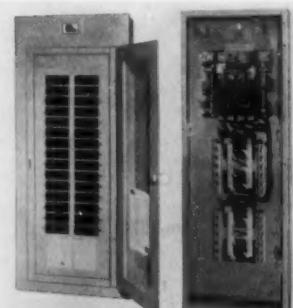
Cutler-Hammer, Inc., 315 N. 12th St., Milwaukee 1, Wis.



Reflector Lamp Fixture (5)

A new vaportight reflector lamp fixture, Type VRL, which produces high light output, has been developed. The fixture is ideal for greater than normal mounting heights, and requires little maintenance. Type VRL takes 300-watt medium base R-40 reflector lamp or 150-watt PAR-38 lamp.

Crouse-Hinds Company, Syracuse 1, N. Y.



Load Centers (7)

A new line of 200-amp load centers with main lugs are available with 20, 24, 30 or 40 circuits. Double main-split bus load centers have 24 or 32 circuits. These latter contain two double pole, fully magnetic circuit breaker mains, installed, which control two separate and equal sections. Boxes contain UL-approved connectors for copper and aluminum conductors, neutrals on top near main lugs, adjustments for flush mounting.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn 16, N. Y.

ARROLET SWITCH BOXES

help
carry
the load of
Modern
Home Wiring



4" OCTAGON BOX
with BF Bracket

This bracket places
box at right angle
to joist. Bracket
prongs are for split
second mounting.
15KNBF

Non-Gangable
SWITCH BOX

Has line-up notches to
gauge wall thickness.
Means precision mounting,
quickly and easily.
180NG

These are modern boxes for modern
home wiring...ideal for your next
job. Write for specification sheets.

Quality Needed for Tomorrow
is in Arrolet Products...Today!

SWITCH BOXES
OUTLET BOXES
BOX COVERS FITTINGS

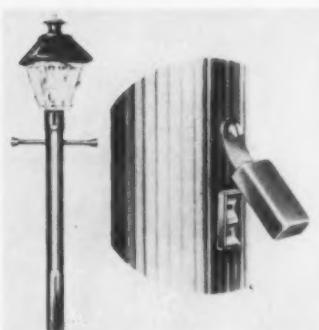
ARROLET
CORPORATION
Montgomery, Penna.

Sales Representatives & Warehouses Stocked: BALTIMORE, MD.
• CHICAGO, ILL. • CINCINNATI, OHIO • BIRMINGHAM, ALA.
• GREENSBORO, N.C. • KANSAS CITY, MO. • LOS
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NEWTON CENTRE, MASS. • PHILADELPHIA, PA. •
RICHMOND, VA. • ROCHESTER, N.Y. • SEATTLE, WASH.
• TAMPA, FLA.

Connector (8)

New BM-51, $\frac{1}{2}$ in. offset indenter connector has single 15° bend. Entering the box at an angle, this connector directs wires into the box at an angle. This angle aims the wires over the box edge and permits a straight line pull that minimizes binding and wire scraping at box edge and fitting throat. An unusual diagonal threading development allows the threads and collar to be put on the fitting body at an angle.

*Briegel Method Tool Co., Galva,
Ill.*



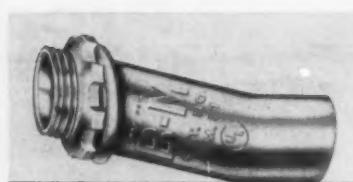
Post Light (9)

A new outdoor lantern post light which contains a weatherproof convenience electrical outlet built into the post. Outlet is located 6 ins. above the ground and can accommodate either a portable TV set, an electric lawn mower, and outdoor rotisserie, or outdoor lawn lights. Fixture is made of rust-proof solid metals, either aluminum, brass or copper with anodized finishes.

*Thomas Industries Inc., 410
South Third St., Louisville 2, Ky.*

Generator (10)

A new packaged brushless generator designed to eliminate sparking for a wide variety of applications has been announced. Shorter and streamlined in appearance, the generator has its auxiliary equipment mounted within the yoke enclosure. The design permits direct mounting of a switchboard on top of the unit, keeping cable runs to a minimum length. Conduit space is located on top of generator to provide an



closure which is integral to the frame. Enclosure provides drip-proof protection for the generator, exciter, regulator and instrument package. Available in 100 kw, 125 kw, 150 kw and 175 kw, 60-cycle, 1800 rpm units, the new generator is designed to deliver a low telephone influence factor (TIF) and minimum radio and TV interference.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Speed Drives (11)

An entirely new line of packaged adjustable speed drives has been introduced. The new Polydene series is available in a wide range of outputs and speed ratios, operate on the proven principle of V-belt-connected, adjustable pitch pulleys. Drives are offered from $\frac{1}{2}$ through 25 hp ac in output speeds from 5 to over 4000 rpm, with standard speed variations of 2, 3, 4, 5 to 1. "Maximum speed variation" (ranging from 6/1 at 25 hp to 10/1 at 1 hp ratings and below) is also available.

*General Electric Co., Schenectady
5, N. Y.*

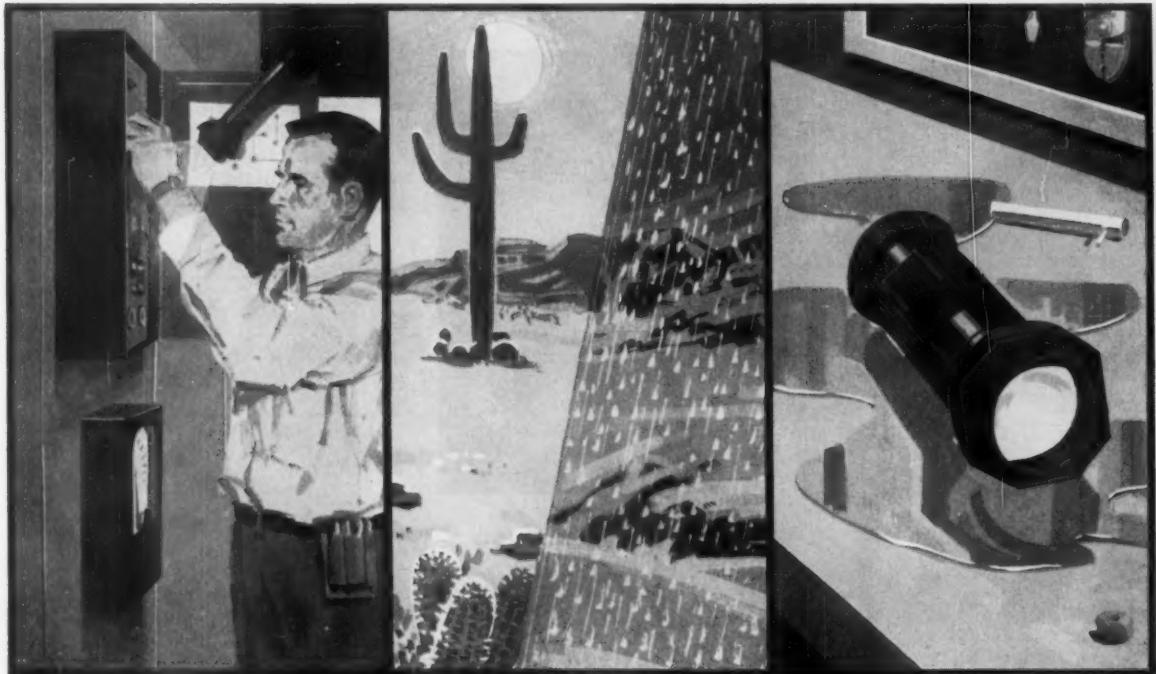


Transformers (12)

A new design of all Sorgel sound rated dry-type transformers up to 10,000 kva, providing maximum versatility for quicker and easier installation, has been announced. As part of their advanced product development program, the manufacturer offers improved transformers having self-supporting enclosures, permitting a more accessible entrance on sides, top, bottom or back. Units up to 75 kva single phase and 45 kva 3-phase are furnished for interchangeable wall or floor mounting.

Sorgel Electric Company, Milwaukee, Wis.

"EVEREADY" "CORDAHIDE" SHOP LITE WITH MAGNET SWITCH ...HOLDS FAST TO STEEL!



HANDY AS A THIRD HAND... comes with powerful magnet switch! Holds fast to any steel surface . . . leaves hands free!

RUGGED AS A ROCK... withstands high and low temperatures, resists shock, takes a beating and comes back for more.

TOUGH AS THEY COME . . . the new "Cordahide" covering insulates against electricity . . . resists alkali, acid, grease, and oil!

New "Eveready" Shop Lites come in a choice of color combinations . . . red, green or yellow. Also available with a standard jumbo switch (Model #314) at a lower price.

GUARANTEED

This "CORDAHIDE" Shop Lite will provide extraordinary service under normal usage conditions. If you are not satisfied, return it to National Carbon Company, St. Albans, Vermont. We will replace it with a standard "EVEREADY" flashlight of comparable value.



No. 316

Guaranteed to be the most useful flashlight you have ever owned

"Eveready", "Cordahide", and "Union Carbide" are trade-marks of Union Carbide Corporation

NATIONAL CARBON COMPANY • Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N. Y.

OFFICES: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco • CANADA: Union Carbide Canada Limited, Toronto



PULL WIRE IN
Minutes
... NOT HOURS!



WITH THE Jet Line Gun

Eliminate fish tape and the long hours spent in snaking!

Use the Jet Line Gun to shoot a strong nylon line through conduit . . . then draw polyethylene rope through and you're ready to pull wire . . . in minutes, not hours!

A small jet-propelled cartridge does the trick, twisting around ell and bends, up and down as it lays the nylon line in runs up to 300 ft. . . . double this distance when shot from both ends of the run!

The Jet Line system is safe . . . there's no powder charge or explosion . . . and both nylon line and polyethylene rope are non-conductors.

The Jet Line system is accurate. You can't waste wire because the polyethylene rope is marked in feet to measure the exact length of wire you need.

The Jet Line Gun was invented by experienced electricians and is now in use by thousands of contractors. It replaces fishing in rigid and flexible steel conduits, under-floor ducts, cavity wiring structures and underground ducts. Goes through floor boxes and condulets.

Order your Jet Line Gun kit today and save time, money and wire on your jobs from now on.

Ask your distributor or write

Jet Line Gun Company

730 Seigle Ave., Charlotte, N. C.

Pat. Pending on
Method and Apparatus

3277

Copyright 1958 Jet Line Gun Co.

Pushbutton Stations (13)

Standard duty pushbutton and selector-switch stations can be mounted flush against the wall. They are rated at 10 amps carry, 600 volts maximum, are designed for control of magnetic motor starters and contactors and will fit any standard single-gang outlet box. Primary applications of switches will be for contractor use in new construction of large buildings such as hospitals, schools, apartment houses, and hotels. Remote operation of air-moving equipment is made possible through use of new stations. Plates, used for single-gang outlet boxes, can be furnished with a 115/230-volt neon indicating light mounted beside the station.

General Electric Co., Schenectady 5, N. Y.



Digger (14)

A new digger for trenching, backfilling, loading and utility duties. Model 210 Utility Backhoe-Loader is designed for digging at practical depths to 10 ft. Individually controlled telescoping stabilizers permit vertical trenching on side slopes up to 10°. Hydraulic 180° swing is foot-controlled to speed dig-and-dump cycles by allowing operator to work boom, crowd, and bucket while pivoting.

J. I. Case Co., Utility Sales Div., Racine, Wis.

Infrared Oven (15)

A new type of infrared oven permits higher ambient air temperatures within the oven. To accomplish this the radiation from each lamp row is projected upward at approximately a 30° angle, which gives better heating of the lower part of the materials being processed. Lamp sockets operate cooler, as socket absorbs less heat from the lamp, and permits 375- and 500-watt R-40 lamps, with hermetically sealed reflector to be used.

Patent-Flex Mfg. Co., Div. of Wilson Inventions Corp., Cloverport, Ky.



Connector (16)

Installing and insulating service entrance phase-wire connections are combined into a single, tool-controlled operation with pre-insulated "Insulink" compression connectors. Connectors can be used to splice aluminum and copper cables ranging from No. 10 str through 1/0 and ACSR from No. 6 through No. 2. Jackets are color-coded to show range of cable sizes accommodated and have guide lines to show how far back to strip cable insulation and where to crimp.

Burndy Corp., Norwalk, Conn.



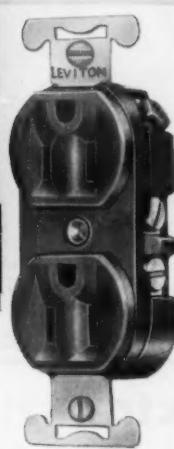
Mobile Workshop (17)

The Shop-Van is a self-propelled, mobile workshop, designed for use in maintenance, repair and overhead assembly. This battery-powered unit will transport 2,000 lbs of tools, materials and equipment. Unit comes complete with telescopic work-platform, battery, bench vise, pipe vise, and a large cabinet. One side of cabinet contains 16 drawers each with inner sliding tool tray, the other side consists of two sliding-door shelf compartments. Drill presses, bench grinders, etc., can be mounted on the 34- by 68-in. table top. The telescopic work platform, which is hand-winch operated, has a raised height of 10 ft, lowered height of 6 ft.

Vanguard Engineering Co., 1908 E. 66th St., Cleveland 3, Ohio



Building:
El Lago Apartments
North Sheridan Road
Chicago, Illinois
Owner:
El Lago Apartments, Inc.
Architect and Engineer:
Irving M. Karlin Associates
General Contractor:
C. A. Thamstrom & Co.
Electrical Contractor:
Avondale Engineering



No. 5014
U-ground duplex
power outlet.
One of a full
line of U-ground
devices for every
residential,
commercial and
industrial use.

**ANOTHER
IMPORTANT
STRUCTURE USING
STRUCTURE USING**
LEVITON
Wiring Devices

**SPECIFICATION
GRADE**

ARCHITECTS, ELECTRICAL ENGINEERS, ELECTRICAL CONTRACTORS everywhere specify Leviton. You, too, can take advantage of Leviton's complete line of Specification Grade wiring devices. Investigate this comprehensive line yourself! Sold thru authorized electrical distributors.

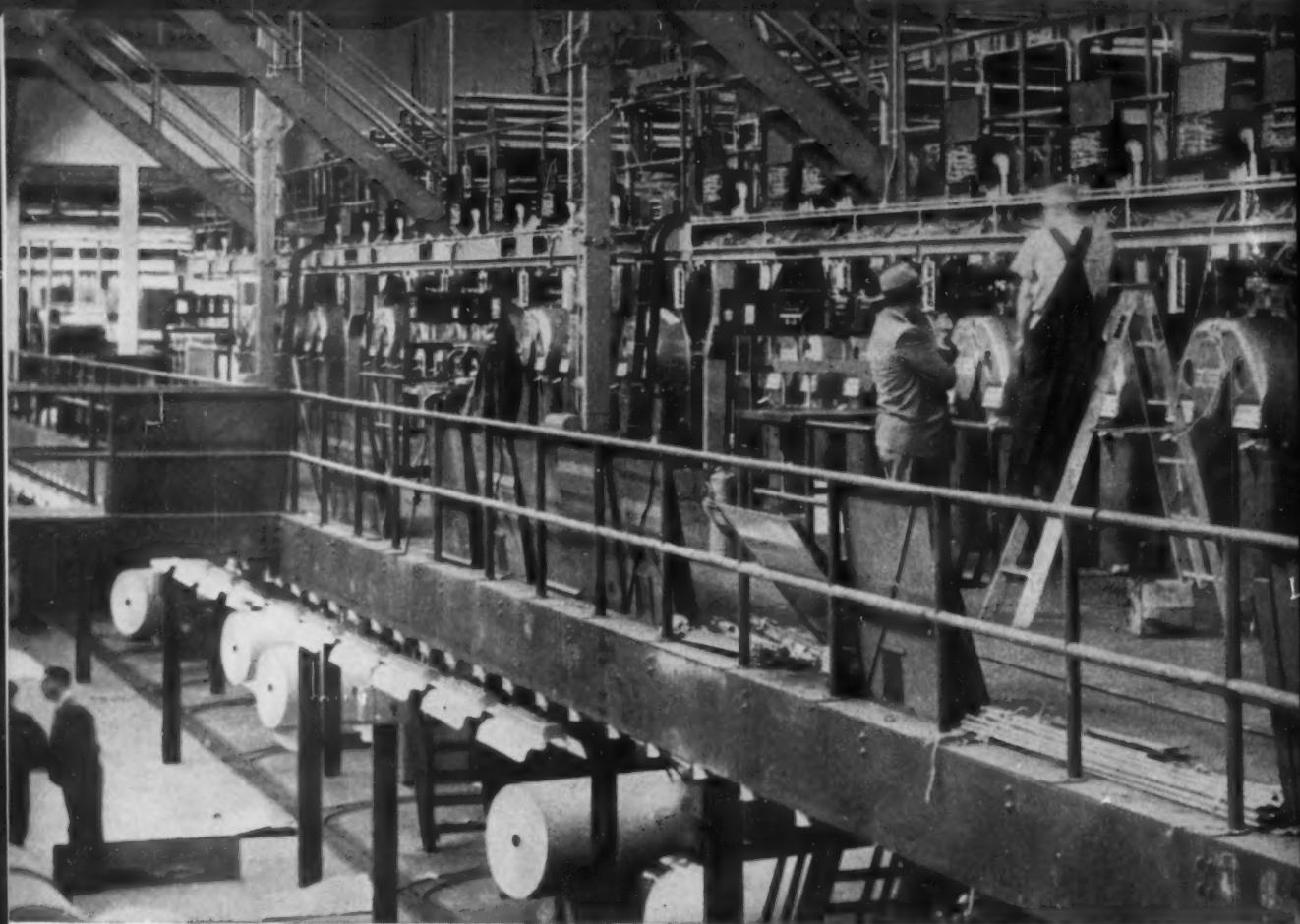
LEVITON

FOR FULL INFORMATION AND CATALOG WRITE TO:

LEVITON MANUFACTURING COMPANY • BROOKLYN 22, N. Y.

Chicago • Los Angeles • Leviton (Canada) Limited, Montreal

For your wire needs, contact our subsidiary: AMERICAN INSULATED WIRE CORPORATION



The news behind the news—is that Anaconda's Densheath 900 feeds the power to these huge Goss presses at the Chicago Sun-Times' new Fort Dearborn plant. Densheath 900's special heat-resistant insulation enables current to be carried.

AT THE CHICAGO SUN-TIMES

An extra margin of safety and increased efficiency are provided by Anaconda's new Densheath 900



Electrician laces in Anaconda Densheath 900 for a 50-hp press-drive motor. In addition to three master panels, each press has its own control panel.

Nothing "spoils" as fast as news. Thus, in a newspaper operation, there's no time for machine breakdowns, costly delays. The news *must* get out!

To see that it does—at the Chicago Sun-Times—Anaconda's Densheath 900 is on the job powering 30 giant Goss presses, plus teletypes, intercom systems, office equipment.

In *your* business, too, power failures can mean *serious* losses. Densheath 900 has the "built-in" extra performance your important circuits require.

Tough, flexible Densheath 900, then, deserves attention. This top-quality industrial wire is sound insurance against power failure. Here's why:

- 1 **LONG LIFE.** Consistently superior performance throughout the years under the severest operating conditions.
- 2 **HIGH HEAT RESISTANCE.** Can safely carry higher currents under exposure to higher ambient temperatures.
- 3 **CHEMICALLY STABLE.** Retains its electrical and physical characteristics despite exposure to cutting compounds, lubricants, most acids and alkalies.
- 4 **MOISTURE RESISTANCE.** The presence of moisture does not affect the satisfactory performances of Densheath 900.
- 5 **EASY TO INSTALL.** Flexible, easily formed, resists tearing, abrasion and stretching, strips easily.
- 6 **LESS "DRAG."** Coated with exclusive new "slipper" coat which offers less drag, greater resistance to scraping.

If yours is a plant now going to higher ambients, or higher temperature operations in corrosive atmospheres, Densheath 900 will be of particular interest. It provides an extra margin of safety for those "hot spots" which



ried more safely . . . is designed for exposure to higher temperatures than ordinary PVC thermoplastic materials. Architects for the new building were Naess and Murphy, Chicago. Electrical Contractor: White City Electric Co., Chicago.

protection against power failures industrial wire - Densheath 900!

are always occurring . . . assures superior performance from your wiring. For contractors and distributors, Densheath 900 offers another advantage: it eliminates duplicate stocks, since the one wire can be used for building construction, appliance and machine tool applications. See the Man from Anaconda or your Anaconda Distributor about Densheath 900. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

58304

RATINGS

The exceptional heat, chemical and moisture resistance of Densheath 900 enables it to satisfy the following:

- *U/L requirements for type TW*
- *ASTM D 734 Polyvinyl Insulating Compound*
- *90C Switchboard, Appliance and Machine Tool Wiring*
- *National Machine Tool Builders Association Specifications*

SEE THE
MAN FROM **ANACONDA**[®]
FOR DENSHEATH 900



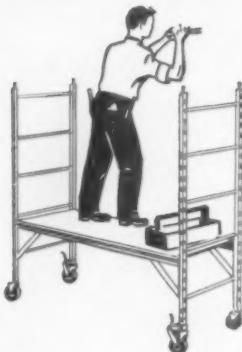
ANACONDA 900 DENSHEATH

DENSHEATH 900

Densheath 900, the 90C industrial wire, is the result of more than 20 years of Anaconda's research and development in the field of thermoplastic wire and cable. Its specially heat-resistant insulation handles current more safely . . . it is designed for exposure to higher temperatures than ordinary PVC thermoplastic materials.

Underwriters' Laboratories Inc. Labeling: Type TW, Oil Resistant 60 C. Sizes 14 Awg through 4/0-Awg also labeled as Appliance Wiring Material for use at temperatures not exceeding 90C, or not exceeding 60C where exposed to oil.

There's Safety and Savings in the BAKER SCAFFOLD



Proper scaffold engineering is of prime importance in all off-the-floor work. Design difference is a major factor in safety and labor costs.

BAKER SCAFFOLDS are designed for fast set-up, easy adjustment and portability with maximum safety at all times. Side trusses are locked rigidly into the end ladder frames—so firmly, in fact, that they can be removed only by manually releasing the pressure of the spring-loaded catch. Yet, adjustments in platform height can be made quickly by one man. And, BAKER SCAFFOLDS lead all other scaffolds in portability and maneuverability.

Check the advantages of BAKER SCAFFOLDS in relation to your specific work. You'll prove to yourself that BAKER SCAFFOLDS are better engineered for safety and savings.



LISTED UNDER RE-EXAMINATION SERVICE
UNDERWRITERS' LABORATORIES, INC.

BAKER SCAFFOLDS

DESIGNED FOR PORTABILITY • BUILT FOR DURABILITY

Write for
Baker Scaffold
Bulletin # 593



BAKER-ROOS, INC.
P. O. Box 892, Indianapolis 6, Indiana

Gentlemen: Send the folder described on
Baker Scaffolds without obligation. **ECM**

Name _____

Organization _____

Address _____

City _____ State _____

DISTRIBUTORS IN PRINCIPAL CITIES

Lighting Fixtures (18)

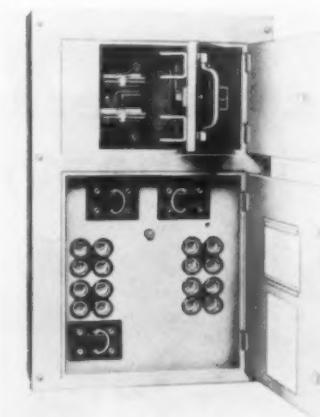
The new Federal fixtures are two-light units and finished in white bonderite and baked enamel. Side shields are of steel or of polystyrene plastic reinforced with integral steel liners. The Federal is shielded by rigid steel louvers. A choice of 35° by 25°, 35° by 45° or 45° by 45° is offered. Top reflectors may be specified for additional downlighting. Catalog sheet is available.

Smithcraft Lighting, Chelsea 50, Mass.

Floodlights (19)

A complete line of new emergency floodlights has everything from a 500-watt portable producing 121,500 candlepower for big-power lighting jobs to a handy, 1½-lb, 150-watt unit for all-around utility use. All units are weatherproof, corrosion-proof cast aluminum with cooling ribs for rapid heat dissipation.

Stonco Electric Products Company, 333 Monroe Ave., Kenilworth, N. J.

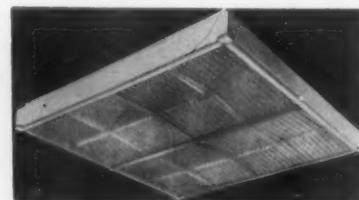


Service Equipment (20)

New 200-amp fusible main service equipment is a 3-pole, 2-fuse, solid neutral mounted directly on cabinet, 120 and 240 volts ac. The 200-amp fusible main switch is the door operated type, and controls all of the plug fuses and "Renu-fuse units." It has three Renu-fuse units, two are 60-amp for the range and water heater, the other a 30-amp is for a dryer, etc. The

Renu-fuse units are also horse-power rated and may be used for heaters, work shops, etc. In addition to Renu-fuse units, the device has 12-16 or 20 plug fuse receptacles, which may be used for 240-volt heater circuits or 125-volt lighting and appliance circuits. Cabinet is available in either surface or flush mounting, with dead-front construction and UL listing.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.



Luminaire (21)

A new surface attached 4- by 4-ft luminaire features the 6024 Controlens and luminous side panels. The 6228 series is designed for application in banks, auditoriums, department stores, offices, churches, libraries, lobbies, etc. The sides of this unit, which also serve as the carrying rails for the lenses, are integral parts made of fiber glass reinforced luminous plastic. The use of a prismatic, acrylic T-Bar, which runs across the center of the fixture supporting each lens, provides a luminous center strip of the same brightness as the lenses.

Holophane Company, Inc., 342 Madison Ave., New York 17, N. Y.

Charger (22)

A completely automatic charger for electric industrial truck batteries, which rides around right on the battery itself. The silicon-rectifier device, with a transistorized control unit, need only be plugged into a 115-volt, ac wall outlet to charge the battery right in the truck. The charger, designated Exide Power Mount, provides fully automatic taper-rate charging system in rectifier-type equipment, and keeps batteries performing at peak capability. Unit is designed for use in one-shift operations with six-cell batteries. Unit comes in three single-circuit models, for batteries with capacities of up to 360, 450 or 660 amp hours.

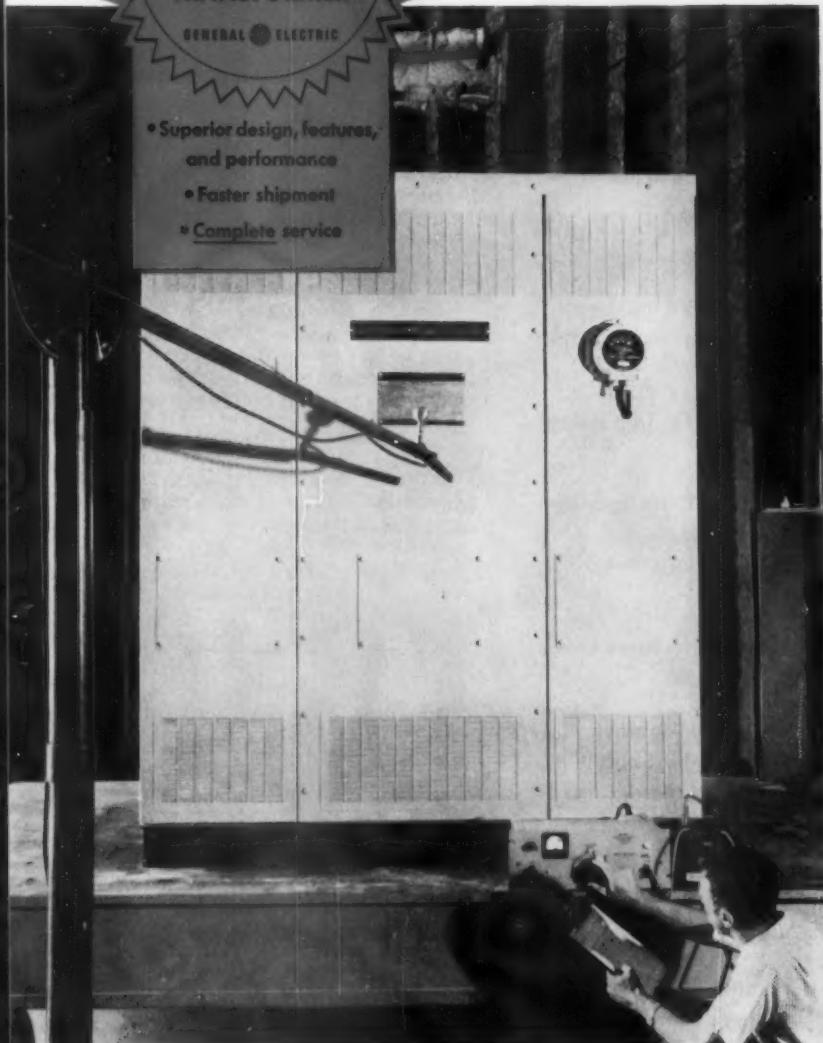
Exide Industrial Div., Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.

FULL VALUE FOR YOUR TRANSFORMER DOLLAR

New G-E dry-type transformers 8 db quieter, up to 14% lighter



- Superior design, features, and performance
- Faster shipment
- Complete service



Quieter than ever; 8 db lighter; built to last longer. That's the story of the all-new General Electric open dry-type transformers, completely redesigned to meet modern commercial and industrial requirements.

New sound levels are 8 db below published standards and G.E.'s new inorganic Alpholite insulation will not deteriorate with time or temperature—provides exceptionally long life for dry-type units. Aluminum conductors reduce transformer weight, simplifying mounting on balconies, catwalks, or overhead platforms.

G-E sealed dry-type transformers with these same superior features are recommended for use where dust- and dirt-laden atmospheric conditions exist.

Product leadership is just part of the story. General Electric's full line of transformers for industry* is certified to deliver **full value** for your transformer dollar . . . in terms of superior products . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. If you examine the **complete package**, we're confident you'll recognize the full value for your transformer dollar offered by General Electric.

For complete information and application help, see your G-E Apparatus Sales Engineer or Agent today. Or write to Sect. 417-8, General Electric Company, Schenectady 5, New York.

* Medium transformers (501 to 7500 kva), Open dry-type transformers (300 to 7500 kva), Sealed dry-type transformers (300 to 7500 kva), Distribution Equipment transformers (112 1/2 to 500 kva), Integral Distribution Centers.

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**



SUPERIOR DESIGN, FEATURES, PERFORMANCE of General Electric transformers is typified by use of new inorganic Alpholite insulation (left) and sound level research.



FASTER SHIPMENT through rapid processing of orders . . . computer design . . . repetitive manufacture.



COMPLETE SERVICE . . . application engineers . . . installation engineers . . . 50 nearby service shops.

NEW BIDDLE

DIELECTRIC TEST SET

5 KV-1MA

Maximum
Output Current
5 MA at
Output Voltage
up to 4 KV



PORTABLE MODEL

- High Maximum Output Current
- Suitable for Impulsing Faults
- Efficient Performance even in Humid Atmosphere
- Full-Wave Dry-Type Rectifier Assures Long Service Life
- Protected Against Damage by Short-Circuit at Maximum Output
- Built for Rough Handling in Field Service
- Available in Portable or Bench Models

This newest addition to the complete Biddle line of dielectric testing equipment has been specially designed for step-voltage resistance tests, voltage withstand, and breakdown tests on the insulation of such equipment as

- rotating electrical machinery, dry-type transformers, switchgear, capacitors and insulators rated from 230 to 500 volts
- traction motors and generators
- wiring and cable installations

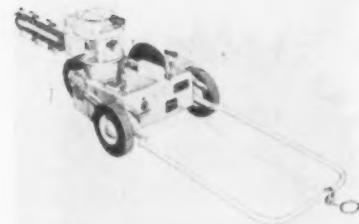
Compact portable set is housed in shock and wear resistant case for severe field use in testing reconditioned equipment after installation, as well as for preventive maintenance of installed equipment. Also available in a bench model for making acceptance and proof test on electrical insulating systems for quality control in manufacturing and repair. For complete description, specifications and prices, WRITE FOR BULLETIN 22-5-ECM.



BENCH MODEL

JAMES G. BIDDLE CO.

Electrical Testing Instruments • Speed Measuring Instruments
Laboratory & Scientific Equipment
1316 ARCH STREET, PHILADELPHIA 7, PA.

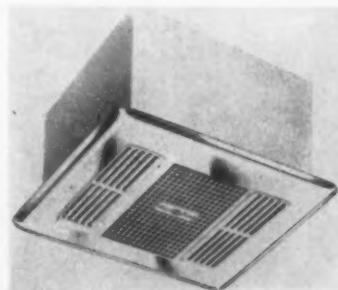


Trencher

(23)

A new portable, self-propelled utility trencher, called the "Davis Pup," is especially designed for installation of underground electrical systems. Unit trenched from 2 ins. to 3 ins. wide and down to depths of 3 ft. It has a positive, variable speed drive with a unique winching mechanism that draws the Pup down the line to be dug. It will attain speeds up to 400 ft per hour. A screw-type self-locking depth control crank lets the operator adjust to desired depth. It is available with both gasoline and electric power. Literature is available.

Davis Mfg. Inc., 1301 South Handley, Wichita, Kansas



Ceiling Heater

(24)

Instant heating recessed bathroom ceiling heater. Flush mounted, only the anodized aluminum grill is visible. Instant heating ribbon element. Automatic overheat safety switch. Rust-resistant anodized aluminum frame. Fan forced. Model BH6 is 1250 watts, 4300 Btu.

Berns Air King Corp., 3050 North Rockwell St., Chicago 18, Ill.

Control Equipment

(25)

"Telecontrol," centralized production control equipment, is now available in a multi-shift design. It permits a plant to switch from one shift to another automatically and without disturbing production data recorded for the first shift on the control panel counters. The same boxes are used at the various machine and assembly stations in the

plant as in the single-shift type. These provide direct telephone, visual and audio communication with the control center through the signalling switch, the "down-time" switch and telephone jack. Sensing devices to transmit production information continuously from each station to the control center are also identical to those used in the single shift version. Monitor cabinet in the control center into which are wired the various communication lines from each station in the plant is of the same type as used in the single-shift model.

Telecontrol Division, Hancock Industries, Jackson, Mich.



Fluorescent Fixtures (26)

A new line of fluorescent fixtures for surface or suspension mounting, called the Fairview series. Units are available in 4- and 8-ft models for rapid-start and slimline lamps. Fixture has a clear, low brightness, prismatic enclosure of Cleartex, with translucent side diffusers to permit uplighting. The enclosure has a single extrusion of new X-5 plastic. Fixture is suited for low ceiling applications in schools, offices, stores and general lighting areas.

Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

Motors (27)

A new line of air-over fan motors in ratings from 1 to 125 hp. These motors are designed for quiet operation in ventilating systems, exhaust systems, cooling towers and all air moving installations where a motor drives a propeller or axial flow fan. In the overall design of air moving installations, this permits use of a smaller, lighter motor for any desired hp capacity. Individual motor nameplates indicate three hp ratings, nominal, operating and maximum, that can be achieved by varying the air velocity across the motor. Motors are available with foot or flange mountings, in totally enclosed and explosion-proof enclosures, and are suitable for vertical or horizontal mounting. Bulletin 2950 is available.

Louis Allis Co., Milwaukee 1, Wis.

EFFICIENCY IS HIGH

when your tool is a

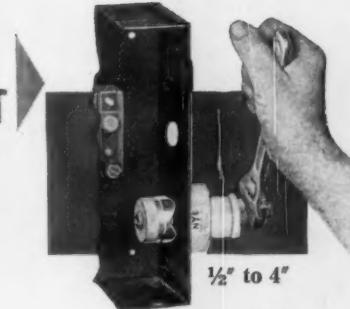


Fifty years of know-how are behind its design and construction. NYE tools are known the world over for dependable performance. What's more, NYE tools are all guaranteed.

Original 4 POINT KNOCKOUT PUNCH

Hand or Hydraulic Operated

Fastest burless punch on the market.
Easiest to use, slugs drop out without
prying.



1/2" to 4"



1" to 2"

NYE 51B RATCHET PIPE THREADER

Has all the important features.
ORIGINAL JAMPROOF DESIGN.
Fast rewind knob. Ask for
demonstration.

NYE 2NP HEAVY-DUTY PIPE CUTTER



1/8" to 2"

5 NEW PIPE VISES

with built-in bender
and pipe rest.

Full range of
sizes 1/8" thru
4 1/2".



1/8" to 2"

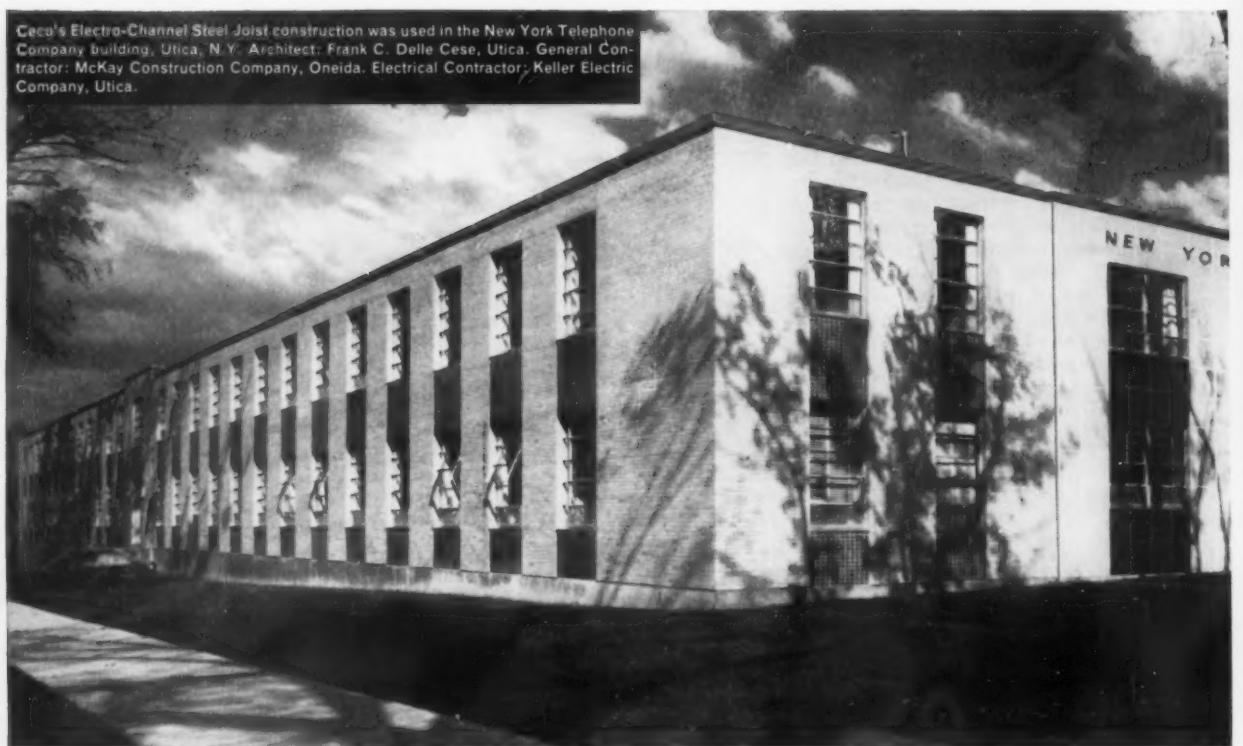
Write for NYE catalog
showing the
complete line
NYE TOOL COMPANY
4126 W. Fullerton Ave.
Chicago 39, Illinois

Name _____
Company _____
Address _____
City _____ State _____

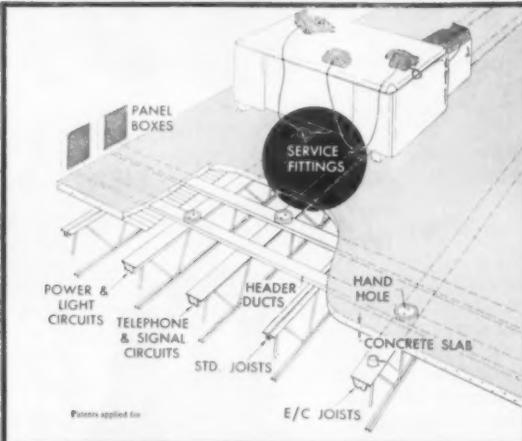
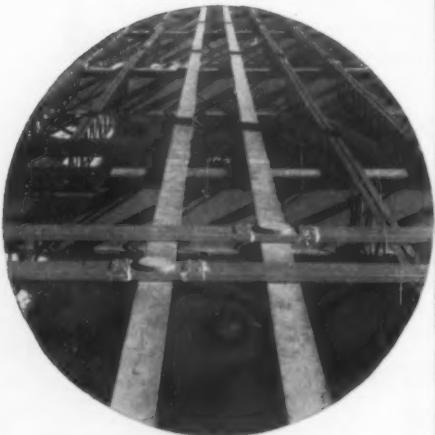
NYE TOOL COMPANY

4126 WEST FULLERTON AVE., CHICAGO 39, ILLINOIS

Ceca's Electro-Channel Steel Joist construction was used in the New York Telephone Company building, Utica, N.Y. Architect: Frank C. Delle Cese, Utica. General Contractor: McKay Construction Company, Oneida. Electrical Contractor: Keller Electric Company, Utica.



IT WILL PAY YOU TO KNOW ABOUT THIS



This construction view shows the clean arrangement of header ducts installed on E/C Joists. These header ducts were installed quickly and economically by an electrical crew which had never installed a system of underfloor electrification.

The E/C Joist system is listed by Underwriters' Laboratories for use with standard header ducts and electrical accessories manufactured by General Electric Company, National Electric Division of H. K. Porter Company (formerly Nepco), and Walker Bros. of Conshohocken.

Electrical, telephone and signal wires are run from the panel boxes down through the header ducts, into the top chord of the E/C Joist and up through the service fittings to desks located anywhere on the floor. Whenever desks are moved, fittings can be installed along the joists to service the new positions.

TOTAL MANUFACTURING FOR THE BUILDING INDUSTRY from raw to finished products



SEND FOR THIS MANUAL

The underfloor electrification system made possible by Ceco's Electro-Channel Steel Joists is described in this Introductory Manual, including suggested step-by-step installation procedures. Job photographs illustrate the simplicity of installation and the use of dual-purpose parts which make this the most economical system of quality underfloor electrification.

INTRODUCTORY MANUAL

CECO ELECTRO-CHANNEL STEEL JOISTS

CECO STEEL PRODUCTS CORPORATION

SEND ON THIS FORM

UNDERFLOOR ELECTRIFICATION SYSTEM

When a new system comes along that affects your bidding and work, it will pay you to know about it. Such a new system is Ceco's Electro-Channel Steel Joist construction for underfloor electrification.

There is no mystery in this construction. Standard parts and methods are used. Your men are familiar with all the tools and techniques needed to construct the Ceco E/C Joist system—even if they have never installed underfloor electrification before.

Owners of both monumental and budget build-

ings are demanding flexibility to prevent electrical obsolescence. The demand can be satisfied by E/C Joists, which provide quality raceways at such a low cost they are practical for any building, large or small. Therefore, underfloor electrification will be used in buildings which could not otherwise have it. That means more jobs for you.

So, learn about this new method. Fill in the handy coupon. Ceco Steel Products Corporation. Sales offices, warehouses and fabricating plants in principal cities. General offices: 5601 West 26th Street, Chicago 50, Illinois.



IN CONSTRUCTION PRODUCTS CECO
ENGINEERING MAKES THE BIG DIFFERENCE

... Steel Joists / Steelforms / Concrete
Reinforcing / Curtainwalls, Windows,
Screens, Doors / Cecoframe
Buildings / Roofing
Products / Metal Lath

CECO STEEL PRODUCTS CORPORATION

5601 West 26th Street
Chicago 50, Illinois

Please send Introductory Manual No. 3011-A covering the Ceco
Electro-Channel Steel Joist system of Underfloor Electrification.

name _____

position _____

firm _____

address _____

city _____ zone _____ state _____

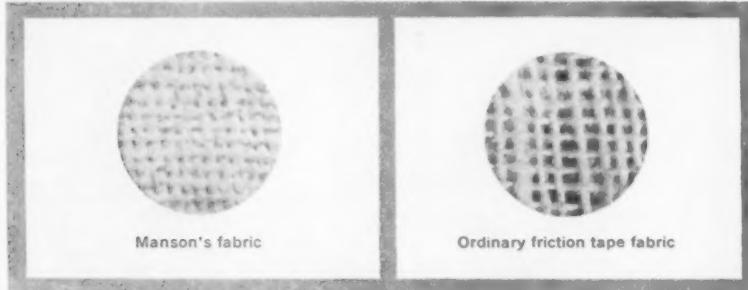
If student, check here for special data.

EC&M

You might profit by knowing the difference between friction tapes...

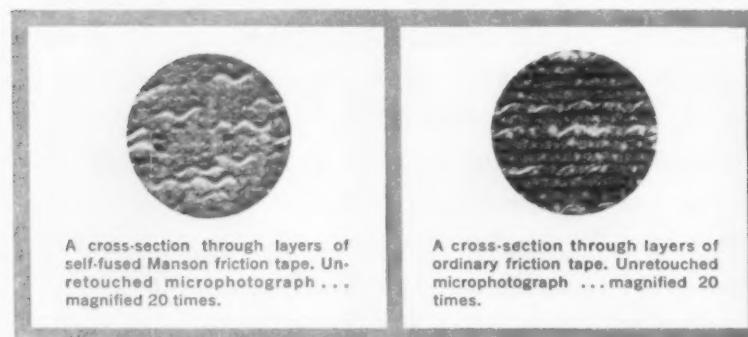
What do you want in a friction tape?

Of course, your first requirement is physical protection. Then, you want moderate electrical insulation and environmental protection. And it seems that almost any friction tape will do that for you. But any friction tape won't. It may do the job . . . perhaps not for long.



Compare MANSON with ordinary friction tapes:

1. Ordinary tape has a fabric backing impregnated with a reclaimed rubber-base insulating compound. Manson has a fabric backing with 20% more fibers, and it is impregnated with a pure 100% natural rubber base insulating compound.
2. Ordinary tape has only two impregnations or frictionings of a saturating compound (one on each side). Manson undergoes three impregnations with its 100% natural rubber compound.



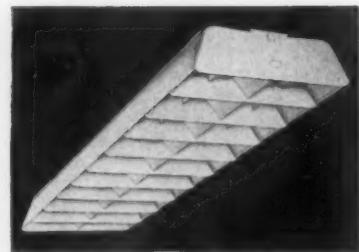
3. Ordinary tape has an adhesive coating on one side. This adhesive holds the layers together. Manson has no adhesive coating. The layers *fuse together* naturally into a tough, long-lasting wall of protection.

These exclusive Manson features give you better performance and long range cost savings. Next time you order from your distributor, ask for Manson.

Manson is made by Okonite—the company that makes superior electrical cables and the splicing tapes to go with them.

THE OKONITE COMPANY

Subsidiary of Kennecott Copper Corporation
Passaic, New Jersey



Fluorescent Units (28)

A new line of commercial fluorescent units designated as the Versateer Series. Unit is designed primarily for modern classrooms, but is also ideal for many other types of commercial lighting applications. It is available for either surface or suspension mounting, in 2- or 4-lamp arrangement, with either 35° by 25° or 45° by 45° lamp shielding.

Benjamin Electric Manufacturing Co., Des Plaines, Ill.



Fire and Burglar Alarm (29)

A new fully self-contained battery-operated fire and burglar alarm system is now available with standardized components for all types of commercial and domestic applications. The Master alarm station includes a bell alarm and may be utilized with additional alarms at desired points or outside alarm warning. Any number of fire-sensing thermal detectors or burglar alarm stations may be incorporated into the system.

Industrial Automation Corp.,
2415 W. Montrose Ave., Chicago
18, Ill.

Lid Covers (30)

Weatherproof lid covers for use on Killark "FS" and "FD" series junction boxes. The covers, Series "FSLCL," make possible the use of larger receptacles for such weatherproof applications as drive-in theatres, trailers, loading platforms, etc. They are made of non-rusting, non-corroding aluminum alloy.

Killark Electric Mfg. Co., Vandeventer and Easton, St. Louis 13, Mo.

*the beauty . . .
the design . . .
the performance . . .
you've hoped for in one switch—*



*Push It, Press It,
Roll It, Rock It*

No matter how you choose to operate the new **ROCKER-GLO**, the merest brush of a finger produces instant action . . . and **ROCKER-GLO** glows in the dark! The switch that looks right, feels right and is right for every type of wiring job.

the new



ROCKER-GLO — **SWITCH**

After intensive testing, Pass & Seymour proudly presents **ROCKER-GLO** . . . the one switch that answers all your needs.

A switch that is trouble-free and packed with eye-appeal.

ROCKER-GLO does the job of all types of switches. It combines toggle action and press action with luminous and quiet features that answer all individual customer needs.

You can tell when it's on or off.

Rocker-Glo — The Specification Grade Switch

AVAILABLE in Despard interchangeable type, Despard type mounted on strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps, 120/277 volts A.C.

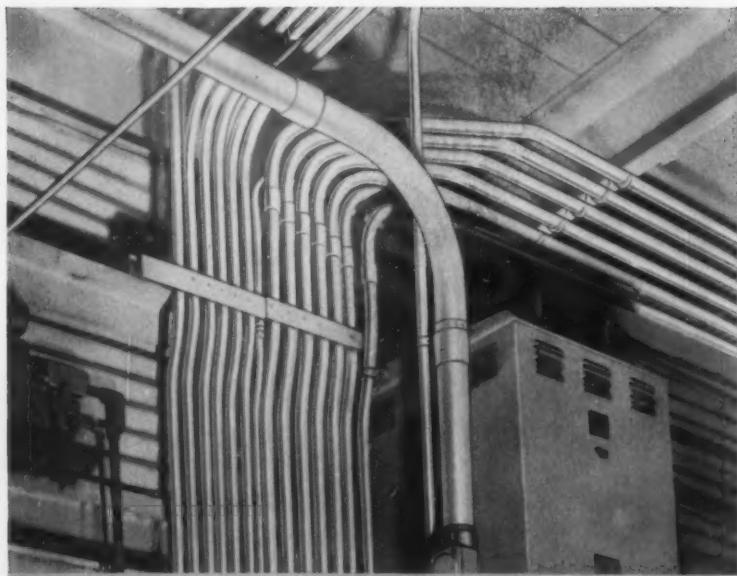
Send for brochure on Rocker-Glo Dept. ECM-759



PASS & SEYMOUR, INC.

SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada; Renfrew Electric Limited, Renfrew, Ontario



REYNOLDS ALUMINUM Electrical Rigid Conduit

cuts installation and maintenance costs!

Reynolds Aluminum Electrical Rigid Conduit offers five important benefits: 1. **LIGHTWEIGHT**. Aluminum conduit weighs approximately two-thirds less than steel conduit. Installation is faster, easier. 2. **CORROSION-RESISTANT**. Aluminum cannot rust—ever—and is corrosion resistant to water, weather and most industrial atmospheres. There are no periodic protective maintenance problems, no rust on walls or surrounding fixtures. No rusting threads. 3. **NON-MAGNETIC**. With aluminum conduit, voltage drop is reduced. Longer conduit runs or smaller conductors are possible. 4. **EASY-WORKING**. Aluminum conduit bends and forms quickly and accurately to meet and by-pass obstacles found in many installations. 5. **NON-SPARKING**. Aluminum will not spark from accidental contact with hard objects. Perfect for use in inflammable areas and atmospheres.

The Finest Products
Made with Aluminum

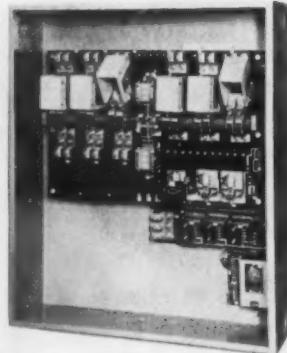
are made with

REYNOLDS  ALUMINUM

Watch Reynolds TV show—"WALT DISNEY PRESENTS"—every week on ABC-TV

For more information
and names of Reynolds Aluminum
Electrical Rigid Conduit outlets, call
your nearby Reynolds Sales Office or
write Reynolds Metals Company, Box
2346-ET, Richmond 18, Virginia.

Also write for descriptive brochure.



Switch

(31)

A new automatic transfer switch, featuring an improved arc chute design that provides positive protection of all main contacts, is available in NEMA Size 6. It is electrically operated, mechanically held and is rated for all loads to 600 volts ac, 250 volts dc. Continuous duty current rating is 600 amps. Ratings are the same for all loads, and for open or enclosed units.

Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.



Hanger

(32)

A new swivel hanger with a free swing of 100 degrees, classified as "earthquake proof" by testing laboratories, is made of steel. The bracket, die-formed and reinforced, mounts on stud or ears of 3½-in. or 4-in. outlet box. Canopy is 5½ ins. in diameter and 1½ ins. deep. It attaches to the bracket with a twist action. Hanger includes a built-in leveling device with a visual scale which allows a full 1½ ins. adjustment after fixture is hung. Unit is finished in baked white enamel. Standard length is 24 ins.

Columbia Electric and Manufacturing Co., 2310 N. Fancher Way, Spokane 10, Wash.



brand new...and —rific!

PARAGON'S 4000 SERIES TIME SWITCH...



With its 40 ampere tungsten rating, Paragon's new 4000 Series has the highest capacity available in general purpose, low-cost time switches.

The 4000 Series is specially designed to avoid problems of contact welding. And with free-floating "make" and "break" contacts, it introduces a new concept in switching mechanisms.



CATALOG 5919 contains complete information on Paragon's new 4000 Series time switch. Write for your copy today!

40 AMPERE T-RATED

33 1/3% GREATER SAFETY FACTOR — Thanks to new 40 ampere tungsten design.

ENDS COSTLY CALL-BACKS — Wiping contacts, no welding, self-cleaning, high conductivity.

LONGER LIFE — Light trip action eliminates strain on motor and gears.

MINIMUM MAINTENANCE — Heavy duty motor and specially lubricated bearings combine for trouble-free, silent, dependable service.

EASY INSTALLATION — Molded terminal block. Heavy unit construction. Large terminal screws. Single pole models equipped with four terminals. No need to force two wires under one screw. Spacious wiring gutter. Easily removable knock-outs in bottom, sides and back.

CHANGEOVERS SIMPLIFIED — Snap-out movement assures fast, easy removal and replacement.

COMPACT STYLING — Case measures only 7 3/4" high, 4 1/4" wide, 3" deep.

EASY TO SET, EASY TO READ — Dial riders are simple to add or remove. Heavy 1-way friction. No need to disengage gears when setting. Dial can be revolved through tripping operations for testing switch operation.

HAND-TRIP CHECKOUT — Manual skip-trip provides hand-tripping of switch . . . either ON or OFF ahead of automatic setting without disturbing automatic sequence.

ASTRO DIAL — Enables time switch to operate according to rising and setting of the sun.

SKIP-A-DAY DEVICE — Permits elimination of operations on any day or days of the week.

TIME IS MONEY — CONTROL IT WITH PARAGON

PARAGON ELECTRIC COMPANY

1614 TWELFTH STREET • TWO RIVERS, WISCONSIN

IN CANADA: AUTOMATIC ELECTRIC SALES (Canada) Ltd., Toronto.

Export Dept.: 15 Moore Street, New York 4, N. Y.

NOW! TWO MODELS FOR NEW VERSATILITY

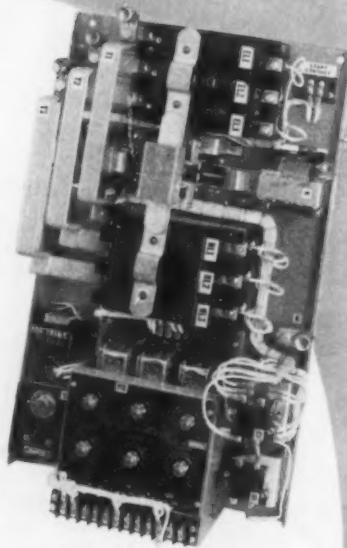
TRANS-O-MATIC* *dual circuit breaker* TRANSFER SWITCHES

NO NEUTRAL POSITION

DOUBLE SOURCE CONTROL

For higher current interrupting capacities, rely on the motor-operated Trans-O-Matic. For low current service, employ the new low-cost solenoid-operated T-100-A. Both are electrically operated... mechanically held, with no neutral position. Both feature Lake Shore's exclusive mechanically-linked dual circuit breaker design for positive two-position transfer.

Available in 2-pole, 3-pole total failure, partial failure, and under voltage protection, with many optional features.



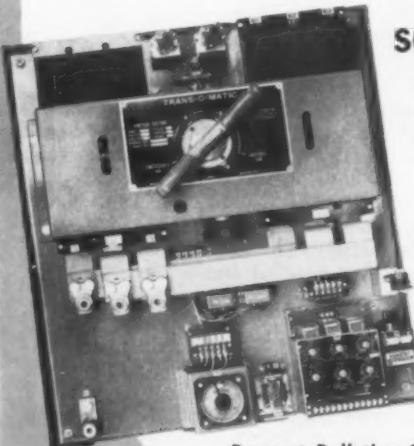
SOLENOID OPERATED

To 600 volts, 100 amps AC with interrupting capacities to 15,000 amp rms.

MOTOR OPERATED

To 600 volts, 800 amps AC with interrupting capacities to 100,000 amp rms.†

† With current limiting fuses.



Request Bulletins 07400-07500

*CANADIAN WESTINGHOUSE, LTD., is licensed to manufacture Trans-O-Matics in Canada.

THE

Lake Shore

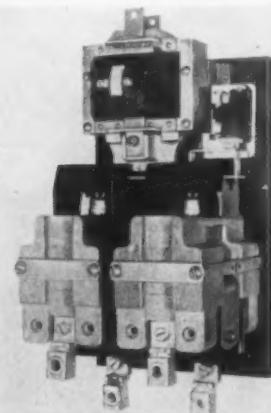
ELECTRIC CORPORATION
206 Willis Street BEDFORD, OHIO



Aerial Platform (33)

A new Strato-Tower series, Model "SL," designed and engineered specifically for use in globe cleaning and street lamp replacement. Featured is a complete unit including truck chassis, Strato-Tower aerial platform and special utility body designed for one-man (driver-operator) operation. A two-man operation unit is also available. Catalog Sheet Form SL-4-59 is available.

Strato-Tower Division, Young Spring & Wire Corp., P. O. Box 103, Elkhart, Ind.



Contactor (33A)

A new 150-amp standard NEMA Size 4, dc solenoid contactor—single and double pole units—designed for use in general purpose and machine tool controllers and for switching lamp, battery and other dc loads. Main features include: double break, silver-to-silver main contacts with integral magnetic blowouts; individual molded arc resistant hoods and arc barriers for each pole; solenoid type power plants; compact unit construction and complete parts accessibility. Standard coils are available for 115 and 230-volt dc operation.

Ward Leonard Electric Co., Mt. Vernon, N. Y.



Chime System

(34)

A new electronic chime system for homes—door chime and intercom. The chime can be transmitted electronically through any remote speaker of the intercom system. When a caller presses the pushbutton at the front door, the homemaker hears the chime through the remote next to her. Without moving, she and the caller can talk back and forth. Two wires connect the chime and the intercom master.

NuTone, Inc., Cincinnati 27, Ohio



Aerial Lifts

(35)

A new "Super" series of completely hydraulically operated aerial lifts mounts on standard truck chassis and are capable of placing overhead worker to height of 100 ft. Boom is a 2-stage telescoping design which mounts compactly on truck in transport position yet erects rapidly to desired position. A completely insulated fiberglass basket with dual safety controls protects two basket occupants from fire or electrical shock hazard. Both lifts have full 360° rotation, raise 75° from horizontal.

Truck Equipment Co., 3963 Walnut St., Denver 5, Colo.

RAWLPLUG
SABER-TOOTH
DRILL-N-ANCHOR

fastest way to fasten to concrete

VL
SABER-TOOTH

It's a drill...and drills its own hole fast, even in hard concrete, with power-operated or hand hammer. Saber-Tooth's core action drills quickly. Drill and anchor are one...matching sizes is no problem. Save the cost of special drills, the time it takes to use, store and sharpen them.

It's an anchor...and holds fast: engineering tests demonstrate holding power up to 17,860 lbs. As you drive it into hole, anchor expands over plug...holding ridges around body resist pull-out. Saber-Tooth anchor withstands severe shock and vibration...double plating protects against rust, corrosion.

THE RAWLPLUG COMPANY, INC.
212 Petersville Road, New Rochelle, N.Y.
Please rush my Saber-Tooth sample and complete facts.

Name.....

Firm.....

Address.....

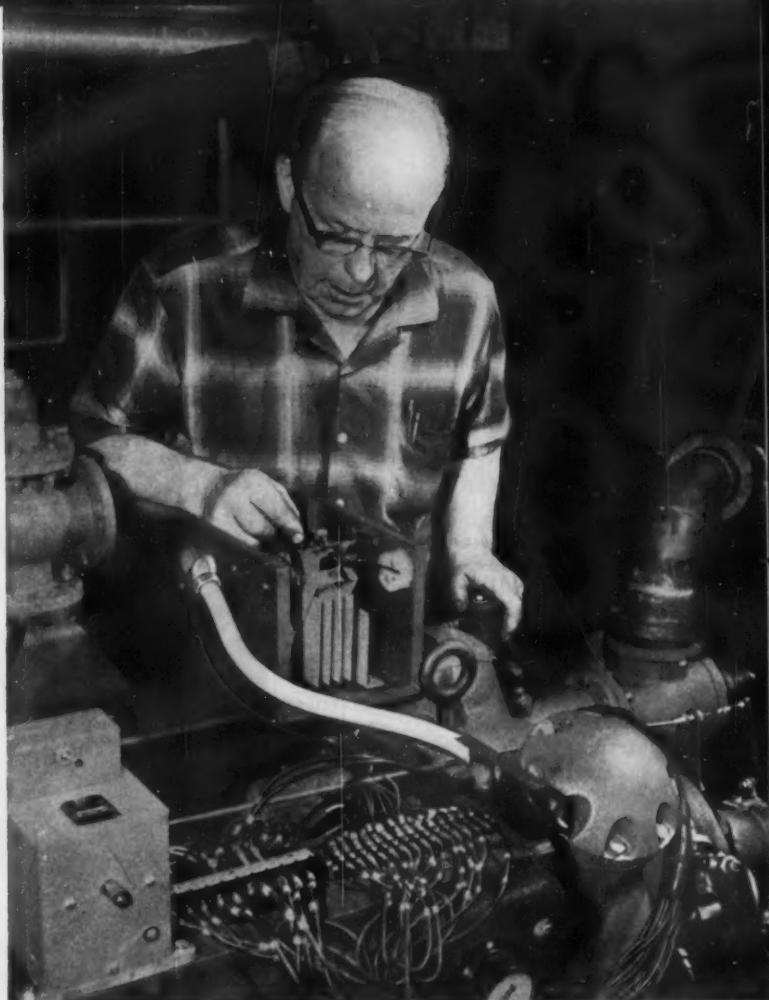
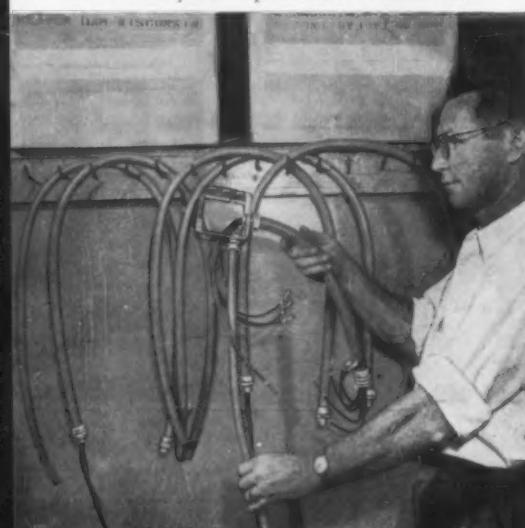
R4



CUT ON THE JOB—NO WASTE. Sealtite comes in long lengths on reels or in cartons.



STANDARD LIQUID-TIGHT CONNECTORS are easy to attach. Sealtite simplifies handling, snaking, is faster to install. *Below:* Ready-Power preassembles connections.

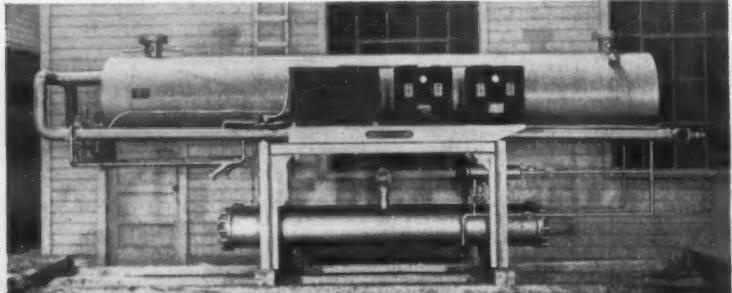


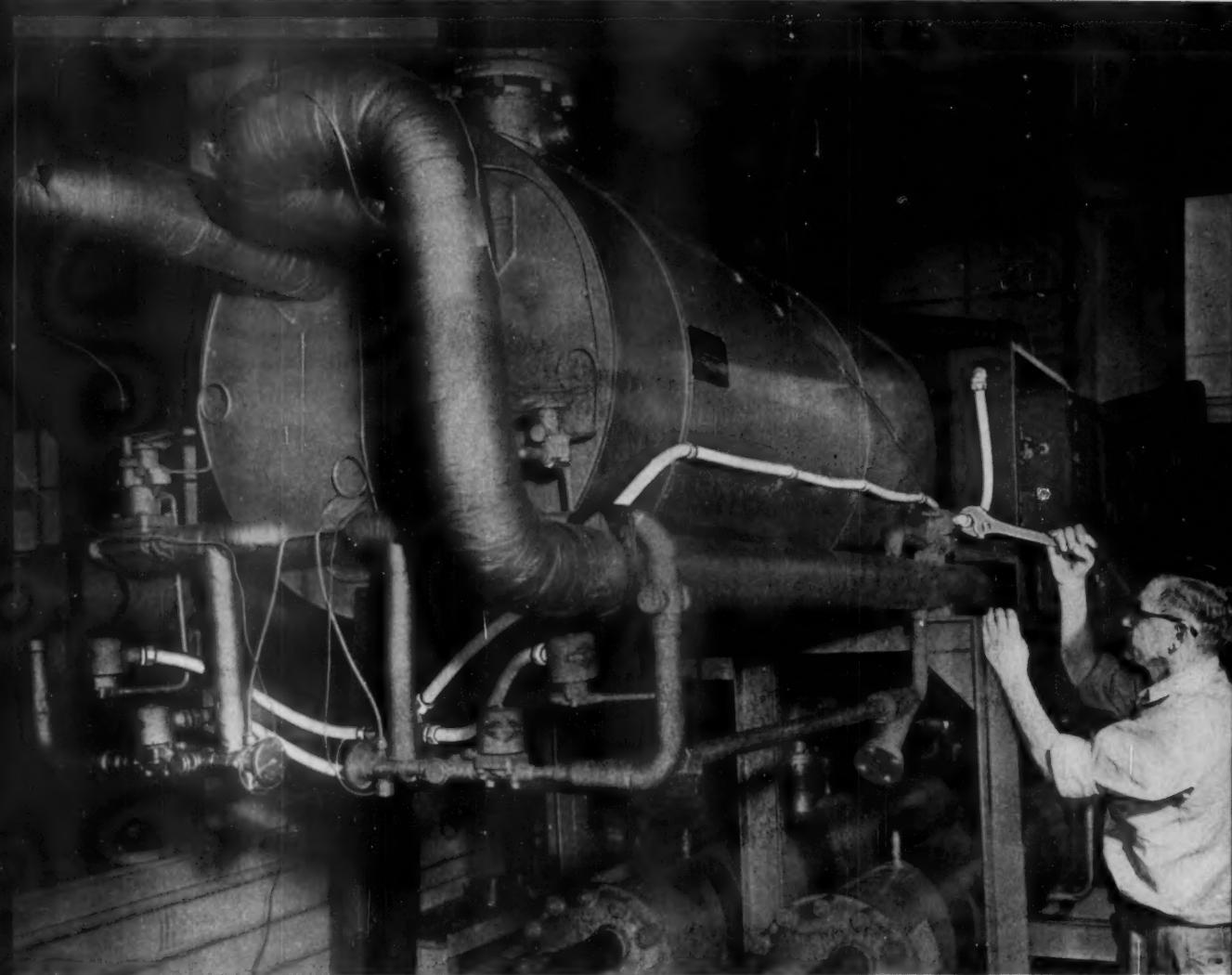
One of the 10 Sealtite conduit-protected connections on the natural gas-engine-driven refrigeration compressors.

Texas sun or New England protects wiring on packaged

Ready-Power Co. finds Sealtite stands up in all environments — makes neater package — speeds production — cuts waste — reduces maintenance.

A completed Ready-Power Chiller-Condenser package ready for installation on the roof of a building in Texas. Ready-Power units are widely used in stores, offices, and factories all over the country.





On the Ready-Power Chiller-Condenser package, Sealite conduit protects 8 electric connections from control cabinet to refrigerant solenoids and to control panels on the two compressors driven by natural gas engines.

winter — Sealite flexible, liquid-tight conduit refrigerant system — cuts production cost, too

The Ready-Power Company, Detroit, Mich., uses Sealite to protect 18 vital connections on its natural gas-engine-driven packaged air conditioning units. Norbert Hall, manager of the Air Conditioning and Refrigeration Dept., says he selected Sealite because it offers better acceptance by the trade, neater and better appearance, easier fabrication, production cost savings, sales appeal, and good performance. Two years of experience with units in the field have justified his choice.

WHERE TO GET SEALITE—Electrical Wholesalers stock Types U.A. and E.F.† Sealite in black or gray. Be cer-

tain you ask for and get the quality conduit marked "Sealite" and "Anaconda" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors.

Send today for free Booklet S-542 which gives full information on Sealite. Write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Sealite is approved by Canadian Standards Association.

†Pat. Applied For 59137



CUTAWAY OF Type U.A.
Sealite shows tough polyvinyl chloride jacket over flexible metal core. Copper conductor wound spirally inside conduit provides ground.

Insist on
the conduit marked

SEALITE®
FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** product

NEW



Concept in Motor Control

BY
**FURNAS
ELECTRIC**

This NEW outstanding line of Magnetic Starters features advanced design to assure superior performance and longer life. It reduces parts inventory and provides quick and easy field modification.



Magnet Assembly

NEW Dual Voltage 110-220 or 220-440 Volt Coil reconnectable on the job. Magnet features just one moving part.



Contact Block

NEW non-tracking Contact Block is impact resistant. Completely visible and front removable silver-cadmium oxide contacts.

WRITE TODAY FOR
COLOR BULLETIN 14-B1, featuring Magnetic
Starters through 400 hp. 1067 McKee Street,
Batavia, Illinois.

FREE



A65



Thermal Overload Relay

NEW trip-free Thermal Overload Relays—manual or automatic reset. Third overload relay kit can be easily added in the field.



Modification Kits

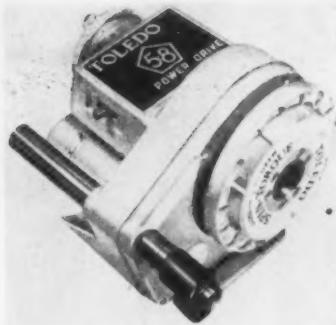
NEW Modification Kits include push button, selector switch, pilot light, and third overload relay.



FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES



Power Drive

(36)

A new lightweight power drive, No. 58, features spin torque chuck with enclosed round jaws; a sealed, factory-lubricated gear train with precision hobbed helical cut gear and ball bearings; a safety factor switch; improved centering device; and heavy-duty base with center screw for bench or stand mounting in any position through 360°. It will handle pipe or conduit from $\frac{1}{2}$ to 2-in. and rod bolts $\frac{1}{4}$ in. and larger.

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4, Ohio

Electronic Air Cleaner (37)

A new electronic air cleaner, known as Model LCT, is designed for either horizontal or vertical air flow and is fitted into the return air duct ahead of the furnace and/or air conditioner. All parts, including collector cell, can be removed from cabinet for cleaning. Cell can be washed in a tub or hosed down with a garden hose, dried quickly and put back into service, within a matter of minutes. Operation of the LCT requires no more electricity than a 40-watt light bulb.

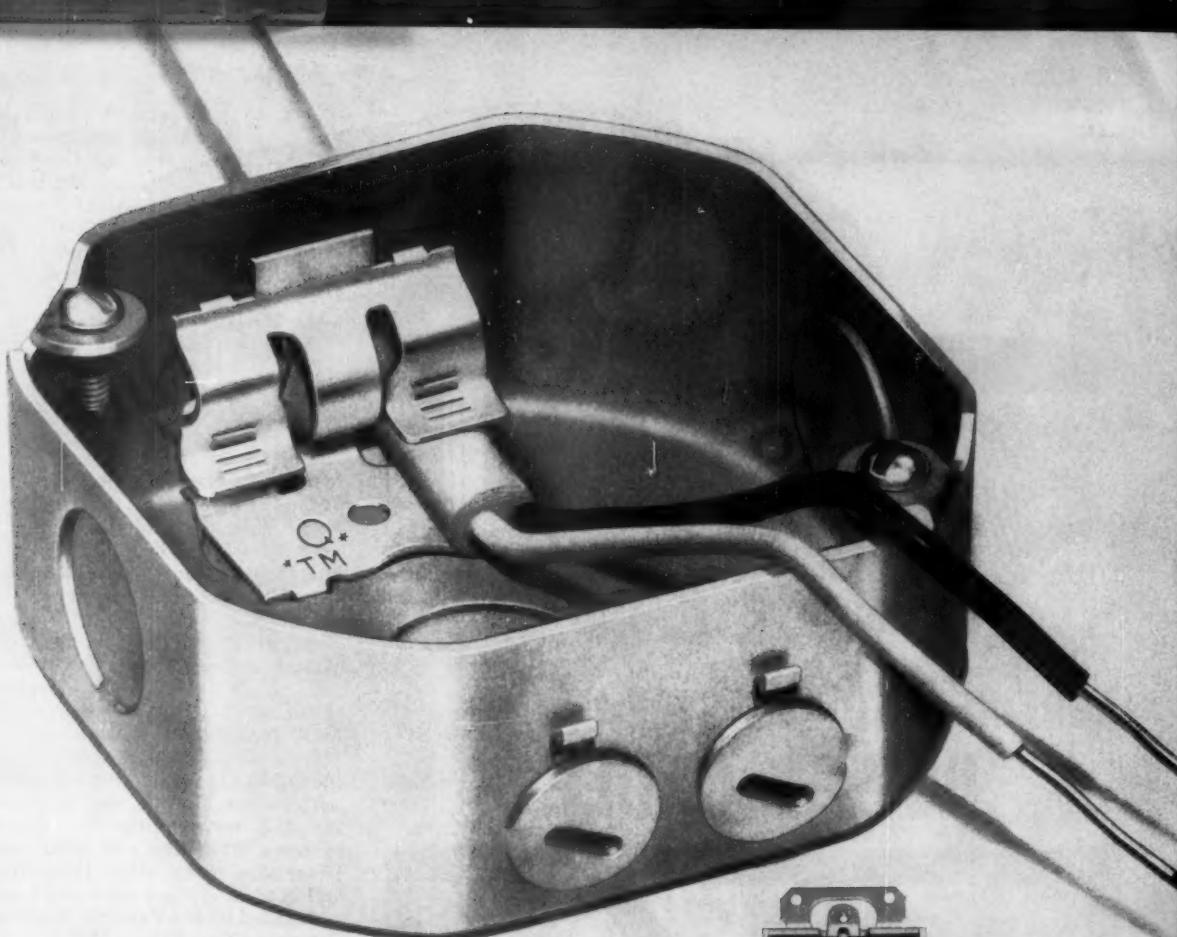
Trion, Inc., McKees Rocks, Pa.

Product Briefs

(38) A new electrician's **knock-out punch** that cuts double-D shape holes for electrical receptacles has been announced by Greenlee Tool Co., Rockford, Ill. . . (39) Ideas, Inc., Laramie, Wyo., has introduced a new **tool**, for attachment to any acetylene cutting torch, for cutting holes for pipes and electrical conduit. . . (40)

W. H. Brady Co., Milwaukee, Wis., has developed anodized aluminum foil **self-bonding nameplates** for on-the-spot recording of permanent information with a typewriter.

(41) A new 1-hole heavy duty **EMT strap** has been introduced by the Paine Co., Addison, Ill.



New RACO "Q"^{*} Quick-Clamp can save hours on the job

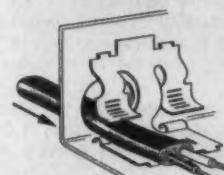
With RACO's New "Q" Quick-Clamp you can install non-metallic sheathed cable in seconds. Simply push the cable through "Q" Quick-Clamp. Cable is held firmly in place, can't be pulled out until clamp is released. To release the cable, apply a little pressure under the clamp with your screwdriver. With the new "Q" Quick-Clamp there will be no more lost time tightening and loosening cable clamp screws...no more stripped screw threads.

And...you'll save an hour or more on the average job (60 to 100 boxes per house). Your RACO Distributor has the New "Q" Quick-Clamp Switch and Outlet Boxes. They're revolutionary, yet so simple to operate. (Exceed Underwriter Laboratories' tests; are fully protected by patents.) See them and try them now.

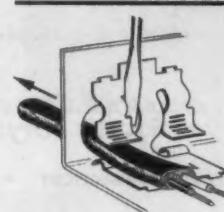
*Trademark



"Q" Quick-Clamp
available in RACO
switch or outlet boxes



Cable moves freely
into clamp and is
gripped tightly



To back-off cable,
release clamp pressure
with screwdriver



ALL-STEEL EQUIPMENT INC. Aurora, Illinois



CONTINENTAL ASBESTOS-INSULATED POWER CABLE

TYPE AVA TO 5000 VOLT
SERVICE available sizes: 14
AWG to 1,000,000 CM inclusive.
Conforms to N.E. code
standard and NEMA standard
WCI-1955 and ASA C8-36
1955.

Engineered insulated wire and cable from Continental Wire
assures maximum Job-Dependability.

Type AVA Power Cable is recommended for use in open
or in conduit installations where advantages of excellent
current carrying capacity and resistance to high temperature
are desired... and where operating conditions in-
clude oil, grease, corrosive vapors or moisture.

There's a complete line of Continental Insulated Power
Cable in sizes 14 AWG to 1,000,000 CM inclusive...
insulation types include AVA... AIA... V... AVB... Sili-
cone Rubber... Glass... Teflon Tape... and Varnished
Glass Tape.

For more information write Continental, Wallingford.

continental
wire corporation

WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

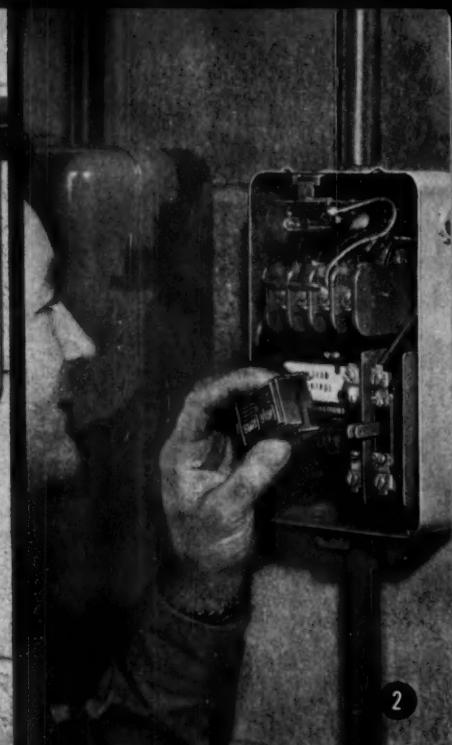
(42) A new transistorized pipe and cable locator has been recently put on the market by Gardiner Electronics Company, Phoenix, Ariz. . . . (43) General Electric Co., Schenectady 5, N. Y., has announced that their standard outdoor time switches are supplied in UL approved rain-tight case. . . . (44) The Grip-Tite Company, Winterset, Iowa, has announced an enlarged line of Grip-Tite expanding earth anchors. The new line is all steel, four way, with asphalt coat.

(45) A new insulation system called Permalex will permit peak loads to be increased an additional 20% of transformer rating with no sacrifice in life expectancy for a new line of pole-type distribution transformers introduced by the General Electric Company, Schenectady, N. Y. . . . (46) Milwaukee Electric Tool Corp., Milwaukee, Wis., has introduced a new Model 160, 16-in. heavy-duty electric chain saw. . . . (47) A new 40-amp, tungsten-rated time switch for all lighting applications from incandescent to neon and for use with pumps, blowers, motors, heating and air conditioning, signal systems, irrigation and filter systems, plus many other industrial and central station uses, has been announced by the Paragon Electric Company, Two Rivers, Wis.

(48) Two and three-way tongue switches can now be electrified with Feedrail "100" trolley busway electrification. It is manufactured by the Feedrail Corp., New York, N. Y. . . . (49) Sun-Tron Corp., Chicago, Ill., has announced full-scale production of its decorator-styled wall and baseboard heating panels for residential, commercial and institutional use. . . . (50) Killark Electric Mfg. Co., Vandeventer and Easton, St. Louis, Mo., has announced a new series of lock-out arrangements for explosion-proof and weatherproof switches and pushbutton stations.

(51) The Electric Products Company, Cleveland, Ohio, has announced the development of a new adjustable-frequency power supply with frequency range up to 10 to 1. . . . (52) The "Arro" expander hammerless setting tool was designed to expand small and medium size anchors in holes that extend through the masonry. It is manufactured by the Arro Expansion Bolt Company, Marion, Ohio. . . . (53) American Super-Temperature Wires, Inc., Winooski, Vt., are now in production with hook-up wires and circuit wires insulated with silicone-rubber.

Flexible
Design
for Easy
Modifications



NEW complete line of low voltage motor control

The modern, flexible design of this new line of Size 0 through 4 Allis-Chalmers control permits making many modifications in the field with ease. Minimum parts requirements facilitate delivery from local stock.

1. A third overload relay can be added to any Allis-Chalmers enclosure in the field, by use of just two screws.
2. Start-stop buttons and selector switch kits are "plug-in" mounted.
3. Only one pilot light kit is needed for any size starter, any standard voltage.
- Auxiliary contacts fit any size starter, 0 through 4.

Accessibility — Wide-open design permits fast installation, modification, inspection and maintenance.

Unsurpassed Mechanical and Electrical Life — Millions of "life test" operations attest to the functional quality in every detail — assure the ultimate in dependable performance and sure protection for personnel, motors and machines.

A complete line of low voltage control (Size 0 through 8) and high voltage control in all NEMA enclosures, plus engineered control systems. Your A-C distributor or representative will give you all the details. *Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.*



A-5985

ALLIS-CHALMERS



RIG TIME IS JIG TIME

PP

MAST KITS

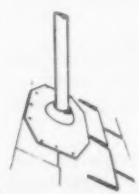
Whether you call it "jig time" or just plain fast, you'll like the speed with which you can complete service mast installations with Porcelain Products Mast Kits. For example, the new flash plate is in one piece . . . just slip it over the pipe, bend it to the roof angle and nail down. Fast, sturdy, sure. The other features too, are first quality throughout, with each part designed especially for service mast usage. They're easiest to install, look the best when in use and give both contractor and home owner best all around service. PP Mast Kits are produced in a full range of sizes and types, and are as close as your nearest electrical distributor. Each is packaged in a single carton, complete except for the pipe. Choose PP for a more profitable installation that will satisfy your most cost and appearance conscious customers. Send for detailed folder — no obligation.

PP

With upper courses of shingles removed, FLASH-PLATE is slipped straight down pipe.



FLASH-PLATE is twisted to conform to pitch of roof and nailed in place.



Upper courses of shingles are replaced and collar is slipped down into place.



PORCELAIN PRODUCTS CO.

225 N. PATTERSON ST.

CAREY, OHIO

Catalogs & Bulletins

(54) BAKING VARNISHES, Class F, for electrical insulation. Complete technical data is presented in new 7-page bulletin. John C. Dolph Co.

(55) ARCHITECTURAL FLOODLIGHTING. Bulletin GER-1555, gives basic engineering details for use of floodlighting to enhance appearance of commercial-type structures. General Electric Co.

(56) CLUTCH-PULLEY unit for direct installation on standard electric motors from 1 to 25 hp is described in a new brochure WEB P-52. Warner Electric Brake & Clutch Co.

(57) TRANSMISSION LINE Armor-Grip suspension application procedure is completely covered in 12-page pocket-size booklet 40-300. Preformed Line Products Co.

(58) ELECTRICAL MARKERS for controllers, conduit, etc. made of vinyl plastic with pressure-sensitive backing are described in new 4-page bulletin 803. Seton Name Plate Co.

(59) LAB INSTRUMENTS — how to use them. 8-page reprint of article includes discussion on instrument accuracy and effects of overloads, ac and dc measurements. Weston Instruments Div., Daystrom, Inc.

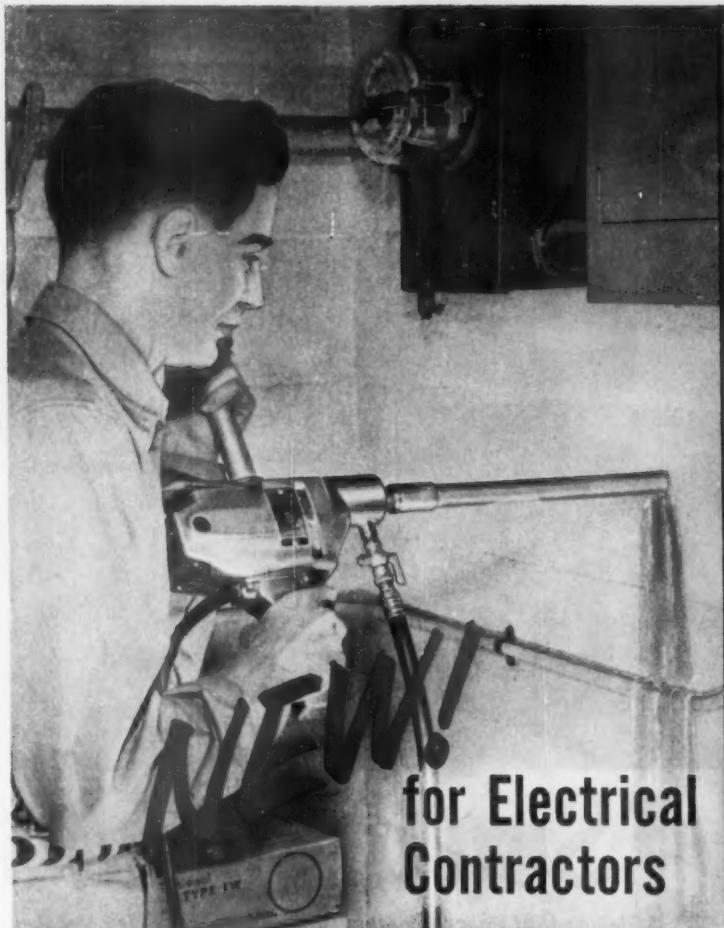
(60) LUMINAIRES for offices, schools, stores and other commercial applications. New fluorescent Versateer series is described in 4-page bulletin. Benjamin Electric Mfg. Co.

(61) MODULAR STORAGE BATTERY components. Three standardized basic cells, with ampere-hour capacities of 220, 125 and 75, are described in 4-page bulletin. Scranton Cellomatic Battery Corp.

(62) SLOW SPEED MOTOR. 2-page bulletin covers features and applications of enclosed motor for small appliances and other low-power drive requirements. Brevel Products Corp.

(63) FOOTSWITCH. Information on new Clipper switch with 7-in. treadle for general purpose applications. Catalog sheet. Linemaster Switch Corp.

(64) TROFFERS. 6-page catalog contains full information on complete line of Speedomatic fluorescent luminaires, with sections on spot boxes and shielding media. Smithcraft Lighting.



Concrete Drilling with DYMODRILLS



MODEL D-514 2800 RPM

Powered by rugged 1/2 HP MILWAUKEE Built motor . . . bit diameter capacities from $1/4"$ through 1". Furnished complete with built-in water swivel, hose, fittings, and steel carrying case.

MODEL D-150 1500 RPM

All-purpose heavy duty model with removable auxiliary pistol grip for close-quarter drilling. Bit diameter capacities from $1/4"$ through 1". Furnished with built-in water swivel, hose, and fittings.

• • • • •



Drill Conduit-Size Holes Faster, Easier —for pennies



For large hole concrete drilling

Rig-Mounted DYMODRILLS with full 2 hp output at the spindle . . . for DYMObits from $1/4"$ through $6\frac{1}{4}"$ diameters. DYMODRILL furnished with built-in water swivel, water hose, fittings and DYMORIG.



A9-8006

With the revolutionary new MILWAUKEE diamond bit DYMODRILL Equipment you can drill through the hardest concrete in just minutes! Your job is finished quicker, cleaner, at far lower cost than with any other equipment.

DYMODRILL Equipment is loaded with features that guarantee simple, safe operation and long life.

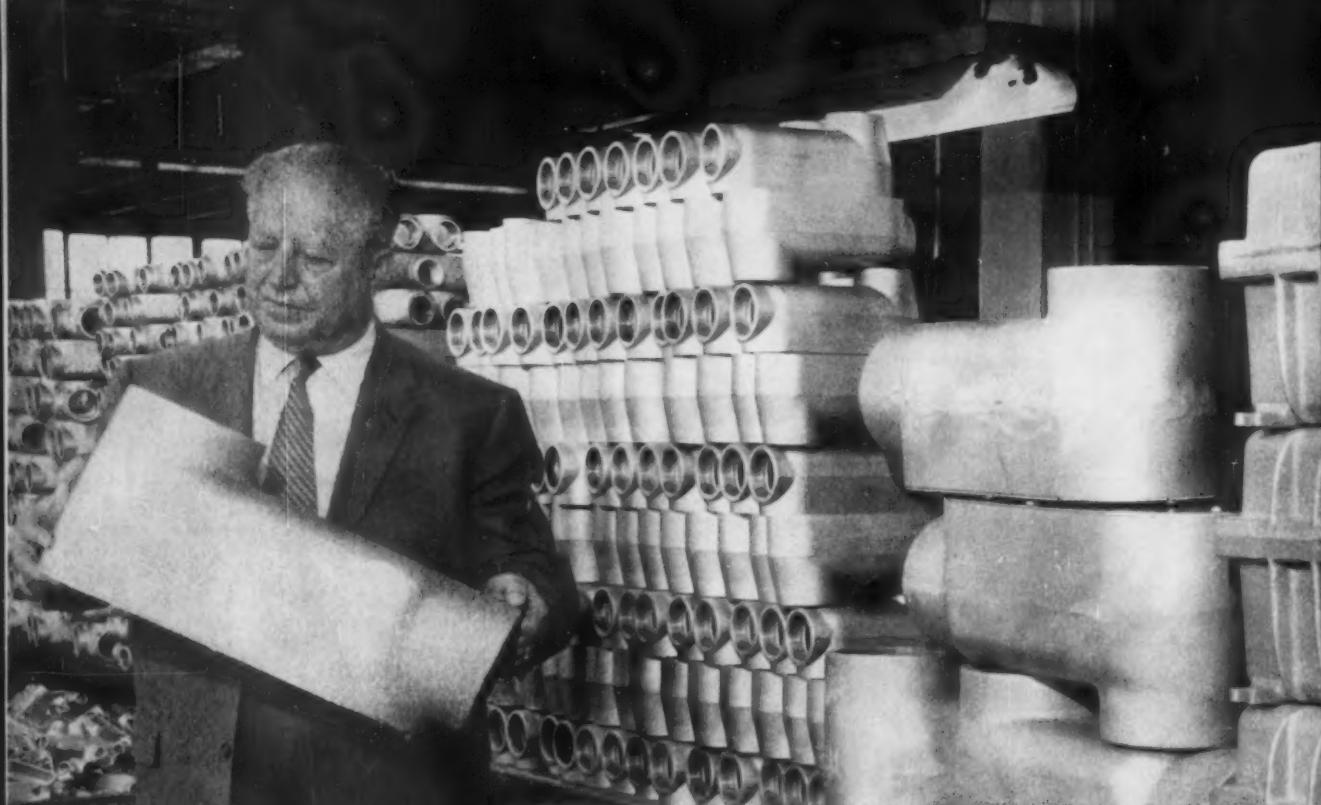
- Built-in leakproof Water Swivel keeps diamonds cool and flushes cuttings.
- Lightweight. Hand-carry it anywhere. Ideal for scaffold work, close-quarter drilling.
- Full Ball and Roller Bearing.

A host of other features and accessories include a wide range of diamond DYMObits in capacities from $1/4"$ through $2"$.

Write for name of nearest MILWAUKEE Distributor for demonstration and FREE Bulletin DD-1.



MILWAUKEE ELECTRIC TOOL CORP.
5386 WEST STATE STREET • MILWAUKEE, WISCONSIN



"Service means

*A Statement of Policy from Jim Grindell, General Sales Manager
Killark Electric Manufacturing Company*

We are proud of the position Killark occupies as the leader in manufacturing aluminum conduit fittings and fixtures. That leadership results from pioneering the use of aluminum, steadily expanding our line and following a dedicated policy of service to the contractor and wholesaler. Killark can give you these advantages.

- 1. Long-term Experience.** More than **FORTY-FIVE** years' experience in the manufacture of conduit fittings, together with almost twenty years as exclusive manufacturers of **ALUMINUM** fittings gives us the "know-how" that comes with time and experience. Killark is the pioneer in this field.
- 2. Modern Design.** We are continually improving design and expanding the line by adding new items. Aluminum fittings have definite advantages in that they are rust-free, more corrosion resistant, lighter and therefore easier to use.
- 3. Complete Line.** Not just a few special-purpose products, but a full line in a complete range of sizes. In fact, Killark offers the most complete line of all-aluminum fittings and fixtures in the country today, and they are competitively priced.
- 4. Efficient Distribution.** The United States and Canada are thoroughly and efficiently covered by 27 experienced Electrical Agents. More than half of these men have been with us 25 years or more. There are 20 strategically located warehouses from which prompt delivery is made, giving you faster service.



Killark

ELECTRIC MANUFACTURING COMPANY
Vandeenter and Easton Aves. • St. Louis, Missouri

America's Most Complete Line of Aluminum Fittings & Fixtures OVER 4500 ITEMS...



many things at Killark"...

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Eastern Sales Co., 1561 Lister Rd.
BOSTON 27
Electrical Agencies, Inc., 49-51 "D" St.
BUFFALO
Eberhardt Electric Sales, 278 Johnson St.
CHICAGO 12
Jack L. Rowe & Son, 2039 W. Jackson
CINCINNATI 37
Arthur L. Ehlers Co., 1031 Meta Drive
CLEVELAND 14
Lusty-Thomson Co., 2140 Hamilton Ave.
DALLAS 2
Geo. E. Anderson Co., 1901 Griffin St.
DENVER 4
Kenneth B. Schumann Co., 1073 Galapago St.
DETROIT 14
Riecher Electric Sales Co., 8319 Mack Ave.

KANSAS CITY 8

Wm. B. Terry Organization, 616 W. 26th St.
LOS ANGELES 33
Kenneth Anderson Co., 123 South Myers St.
MILWAUKEE
Martin-Gaertner Sales Inc., 1108 North Third
MINNEAPOLIS 2
Harry P. Smith Co., B26-27 Andrus Bldg.
NEW YORK CITY 33
W. J. Wickenheiser Co., 600 West 181st St.
OMAHA
W. C. McConkle, 8115 Gold Ave.
PHILADELPHIA 3
Harry G. Anschutz Co., 113-115 N. 23rd St.
PHOENIX
Kenneth Anderson Co., c/o Mr. Melvin C. Long,
422 S. 7th Ave.
PITTSBURGH 9
Crescent Sales Co., Inc., 4830 McKnight Road
RICHMOND
W. E. Sullivan, Jr., 6211 A West Broad St. Rd.

SAN FRANCISCO

F. M. Nicholas Co., 714 Harrison St.,
SEATTLE 4
Northwestern Agencies, Inc.,
4130 First Ave., South

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MONTREAL, QUEBEC
Harry J. Isserman, 5235 Kensington Ave.
REGINA, SASKATCHEWAN
MacKay-Morton, Ltd., 2226 Dewdney Ave.
TORONTO, ONTARIO
Hodgson & Powell Co., Ltd., Box 123,
Postal Station K, 1909 Yonge St.
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Griffon Sales Limited, 551 West 8th Avenue
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TORONTO



BRONCO

Certified

66
NEOPRENE

PORTABLE ELECTRICAL CORD AND CABLE
has the **HIGHEST
NEOPRENE
content in the
industry**



The protecting outer jacket on Bronco 66 Certified contains 67.32% Neoprene—highest in the industry! This is why your Bronco 66 cable, last longer, have greater resistance to oil, ozone, sunlight, heat, flame, chemicals, and abrasion.



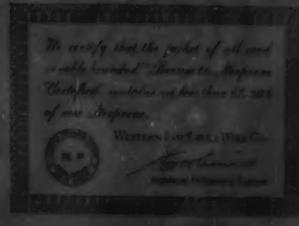
BRONCO TAKES THE GUESSWORK OUT OF CABLE BUYING

How do you know your type SO and/or type W, G & Control cable is the best that can be had?

Look For These Two Symbols of Certainty:

1. Branding—"Bronco 66 Certified—67.32% Neoprene" is molded* into the jacket at two foot intervals.
2. Each carton and reel carries a registered certification as to jacket contents signed by a professional engineer. When you find these guideposts, then you will know that you have the best.

*U.S. PATENT #2867021



WESTERN INSULATED WIRE CO.

(65) CABLE INSULATION TESTS. Bulletin RCT 712 features a discussion of observations derived from thousands of dc overpotential tests, describing the results of the tests and the nature of dc failures in cable insulation. Rome Cable Corp.

(66) ALUMINUM CONDUIT—What About It? 14-page booklet describes its history, analysis of arguments for and against the product, and conclusions as to the relative merits of steel and aluminum for raceway. Pittsburgh Standard Conduit Co.

(67) CONTROLLER. 4-page catalog covers new electronic signaling controller for accurate and automatic control of industrial processes, furnaces, ovens, and other equipment. Thermo Electric Co., Inc.

(68) ADJUSTABLE-SPEED DRIVE for calendering. Bulletin GEA-6910 describes the combating of cost/profit problems with a planned program of drive modernization. General Electric Co.

(69) SCHOOL LIGHTING booklet, "The A-B-See of School Lighting," 24 pages, gives explanation of factors involved in producing good light for good sight, amount of light required for specific tasks, and illustrations of various fixtures with performance charts. Smoot-Holman Co.

(70) LIGHTING CONTROL for theatres, auditoriums, schools and similar installations. 8-page bulletins EPD 5426-1 and 5416-1 include photographs and dimensional drawings of dimmer units, power unit, console and other components of Mark II and Mark III systems. Vickers Inc., Electric Products Div.

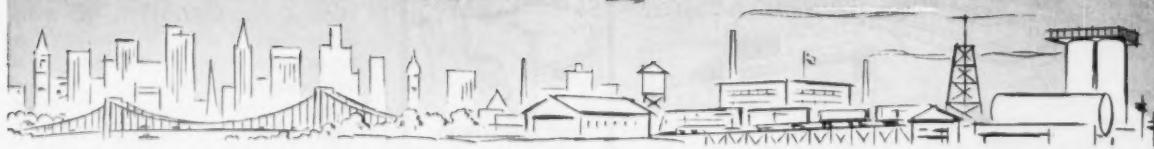
(71) DISCONNECT SWITCHES, hook-operated. Bulletin PSE8 gives design features of single-blade, single-throw; single-blade, double-throw; and tandem-blade, single-throw switches. Line Material Industries. McGraw-Edison Co.

(72) WIRE AND CABLE REELS—the do's and don'ts of handling. Posters graphically and humorously illustrate care in transporting and handling reels to increase their life and reduce damage. National Electrical Mfrs. Assn.

(73) LUMINAIRES. 14-page booklet illustrates and describes complete line of Modulume lighting equipment, including wood and plastic units with complete specifications and layout data. LAM Inc.

(74) CONTROL CABLE with polyethylene insulation and double PVC jackets. Bulletin DM 5844 electrical characteristics and technical data. Anaconda Wire & Cable Co.

SCOPE



* STROMBERG CENTRAL OPERATIONS PANEL-ELECTRIC

Easily and economically installed, SCOPE conserves power, fuel and water, actually lengthens the life of associated operational equipment by tailoring "on" time to fit specific program requirements.

Now... from a recognized leader in the field of intricate timing devices and time control systems comes SCOPE (Stromberg Central Operations Panel—Electric).

SCOPE controls remote equipment *without* special or additional system wiring.

On a pre-determined schedule, SCOPE automatically controls the "on" and "off" operation of equipment in schools, offices, industrial plants, department stores and public buildings of all kinds. Thanks to such components as Stromberg's renowned Master Clock, Program Instruments and Electronic Transmit-

ter, SCOPE can control up to 60 electronic circuits.

With the addition of auxiliary panels, it can control up to 160 circuits on one electronic frequency.

Operating with *four* frequencies, a single SCOPE panel will control 640 circuits.

In any standard installation, SCOPE will "mastermind" the programmed operations of heating and air conditioning, lighting, clocks, audible signals, attendance recorders, time stamps, locks, pumps, valves and motors.



A complete catalog—TIME AND SIGNAL EQUIPMENT—prepared especially for Architects and Engineers—is yours for the asking.

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Sales & Service Offices throughout the U. S. A.



SUBSIDIARY OF GENERAL TIME CORPORATION

"more for your money"



**UTILCO
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LOWEST COST • SERIES TC



Buy yours individually
or in pairs

Any way you want them
we have them!

TOOL COMPARTMENTS

Adaptable • Versatile • Economical. Series TC Rugged Tool Compartments are designed so that you can mount them on any pickup truck or flat bed vehicle. Buy them any way you want them. Individually or in pairs with or without part trays. They convert the most ordinary pickup truck into an efficient workable service vehicle by adding lockable carrying space for tools, parts and other equipment without sacrificing loading area. $\frac{1}{2}$ Ton Pickups require TC-72 and $\frac{3}{4}$ Pickups require TC-84. Complete mounting instructions are furnished with TC Tool Compartments so that they can easily and economically be transferred when you replace your truck.

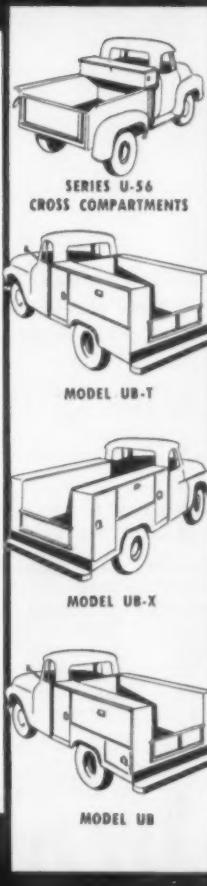
OPTIONAL EQUIPMENT

- Overhead Ladder racks
- Vise Brackets
- Pipe Carrier with tension clamps
- Sliding Steel Covers, etc.

Write Utility Body Company or telephone your nearest distributor for complete information.

UTILITY BODY CO.

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MODEL UB

(75) ELECTRIC MOTORS from 1/30 to 1 hp. 4-page bulletin 138 lists standard line with prices and specifications. Motor Appliance Corp.

(76) TEST SETS. New catalog data sheets describe hipot testers, dc overpotential testers, corona test sets, production-type insulation testers, wire sparkers, continuity and leakage testers, and fault locating sets. Peschel Electronics, Inc.

(77) SPLICE KITS. Catalog JD, 6 pages, gives complete information on pre-engineered kits for splicing plastic-covered telephone cables, aluminum or copper shielded. G&W Electric Specialty Co.

(78) LIGHTING EQUIPMENT for critical seeing tasks in drafting rooms, libraries, executive offices and classrooms is described in 12-page loose-leaf information file, including Spacialite, Budgetlite and Magna units. Ainsworth Lighting, Inc.

(79) ALUMINUM WELDING. Comprehensive survey of techniques of welding aluminum using gas-shielded metal arc and tungsten-inert-gas processes is presented in 120-page book. Air Reduction Sales Co.

(80) ADJUSTABLE-SPEED DRIVE for extruding. Bulletin GEA-6909 features drive selection information to help determine the type that most completely and economically meets requirements. General Electric Co.

(81) VOLTAGE REGULATORS—their application, description, selection, weights, dimensions, and connection diagrams. Liquid-filled and dry types. 60-page booklet. General Electric Co.

(82) DOOR INTERLOCK SWITCH. 2-page data sheet describes subminiature unit for use on high-voltage cabinets and electronic cabinets. Micro Switch.

(83) INSULATION PRODUCTS. 20-page catalog 31 describes standard packaged slot insulations, formed fibre and shaped wood wedges, and formed polyester film wedges. Insulation Manufacturers Corp.

(84) SILICON RECTIFIER. New data sheet presents complete description, data and specifications on power rectifier with peak inverse voltages ranging from 50 to 400 volts. Syntron Co.

(85) LIGHT DIMMERS. Luxtrol units in three capacities: 450, 800 and 1800 watts for incandescent and fluorescent lighting installations are described and illustrated in new 20-page booklet L758W. Superior Electric Co.



PART OF THE 14-MILE PERMALINE CONDUIT installation by Milwaukee Division of Wisconsin Telephone Company. The section shown is in Racine County. The installation, which carries principally intercity trunk lines, was laid in six- and eight-duct runs, in five-foot trenches, with four feet of cover. The L-M Flush-Fit couplings (arrows), which are the same outside diameter as the conduit, permitted a faster installation, requiring a minimum of concrete. This Permaline installation, made in 1956, has been completely trouble-free.

Two-Year Test Shows L-M Flush-Fit Couplings OK on Fibre Conduit

In the fall of 1956, Wisconsin Telephone Company laid a 14-mile run of L-M Permaline Conduit, consisting of six- and eight-duct runs carrying intercity trunk lines.

Unusual Methods Speed Job

To speed up this installation, the contractors used L-M Flush-Fit couplings. These are tapered couplings with the same outside diameter as the conduit itself. They permit one conduit to be laid directly on top of another, doing away with vertical separation and resulting in considerable savings in concrete.

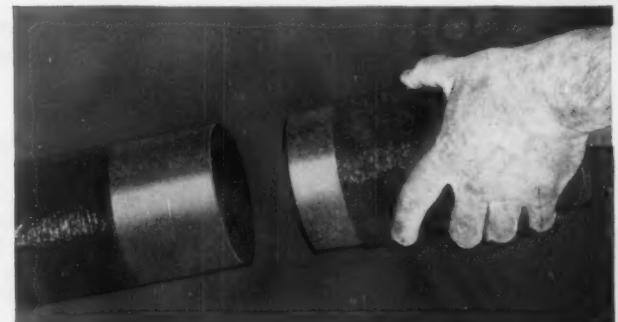
To maintain horizontal separation, wooden forks were used while the concrete envelope was poured. Upon completion of pouring, the forks were removed and reused.

Get Data on Permaline

Permaline Conduit offers many advantages, such as smooth inner bore, consistent high quality, and the Permaline-engineered conduit system with complete procedure, couplings, bends, bell ends, and all other equipment for a fast, efficient installation. If desired, Permaline Conduit is available on skids, in fork-lift bundles, or in steel-strapped slings.

L-M Permaline is offered in sizes 2" through 6", in 5, 8, and 10-foot lengths that save even more time. The most complete line of sizes and lengths. The most complete stocks—in 76 warehouses throughout the country. The largest number of L-M representatives and fibre products specialists to help you engineer your jobs.

Ask the L-M Field Engineer or specialist for free sample of Flush-Fit Coupling and information on this and Permaline Conduit; or write Line Material Industries, Milwaukee 1, Wisconsin, for a copy of L-M's 12-point plan folder and Bulletin UGIA. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



THE L-M FLUSH-FIT tapered coupling is formed of light, strong POLYFLEXON plastic. Outside diameter is the same as that of the conduit, so there is no bulge or extra thickness at the joints. On request, L-M Permaline Conduit is shipped with an L-M Flush-Fit coupling attached at one end of each length—without extra charge.

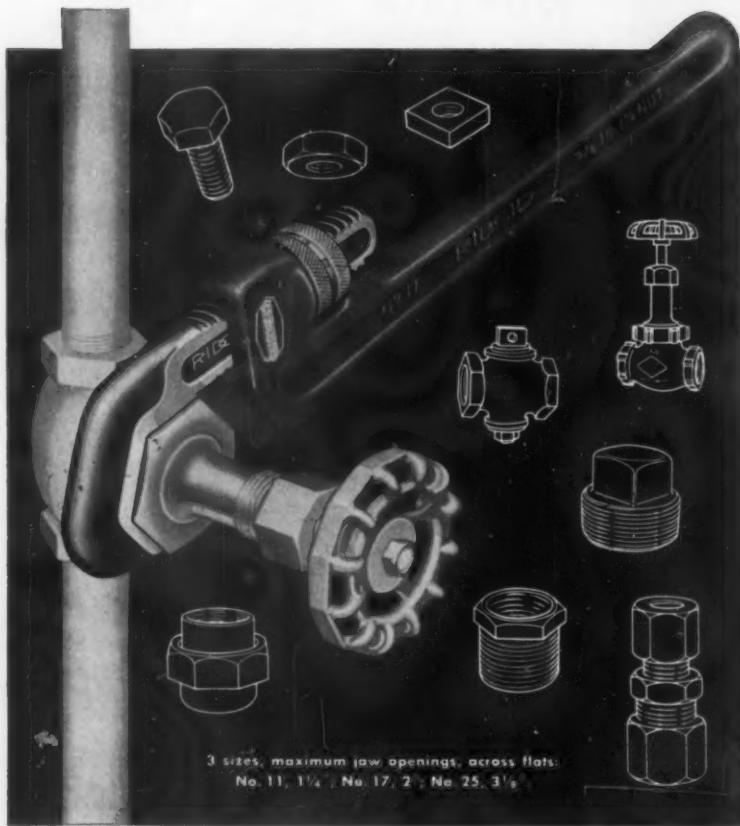


LINE MATERIAL[®] Industries
McGRAW-EDISON COMPANY

Permaline Fibre Conduit



378R



Master of Every Nut and Bolt...

**NEW RIDGID®
Hex Wrench**

**Wide-open fast-action multi-sided grip
on every hex, square and flathead!**



"Got the RIDGID
name on it? . . .
Okay, I'll take it!"

Quick adjustment—stays to size . . . this new Hex Wrench goes on easily, won't slip off—harder you pull, the tighter it grips . . . no more skinned knuckles or rounded nut shoulders! Narrow jaw for close quarters. Famous RIDGID heavy-duty design, guaranteed housing, comfort-grip handle. Three sizes for $\frac{3}{8}$ " to 2" nuts. Make your work easier and faster—buy new RIDGID Hex Wrenches at your Supply House!



The Ridge Tool Company

Elyria, Ohio, U.S.A.

THREADED PIPE... It's Tight... It's Best... Costs Less!

(86) **CELLULAR FLOORS.** 8-page brochure details design and application methods for headerduct and fittings for cellular steel floors used in power, communication and signal distribution. Conduflor Corp.

(87) **THREE-PHASE MOTORS.** GEA-6932, 2-page bulletin, covers inherently protected, integral-hp motors for fan, blower and compressor applications. General Electric Co.

(88) **LIGHTING UNITS.** New RLM specifications for incandescent and mercury vapor upright porcelain enamel and aluminum units. RLM Standards Institute.

(89) **CEILING LIGHTING.** New 4-page brochure on Panel-Luminous ceilings shows ten different diffuser panels supported on 1-in. aluminum track system. Luminous Ceilings Inc.

(90) **SUBSTATION TRANSFORMERS.** Bulletin GEA-5452A, 8 pages, describes Power Master transformers rated single-phase, 500 kva and below, and 3-phase, 15 kv and below. General Electric Co.

(91) **RHEOSTATS.** 12-page bulletin 41 describes line of Jagabi laboratory and switchboard-mounting units, wire-wound and carbon pile. James G. Biddle Co.

(92) **TELEPHONE CABLE** for use in aerial, duct and direct burial service is covered in technical booklet, with data on construction of plastic cable for from under 25 to 400 pairs. Rex Corp., Telephone and Control Cable Div.

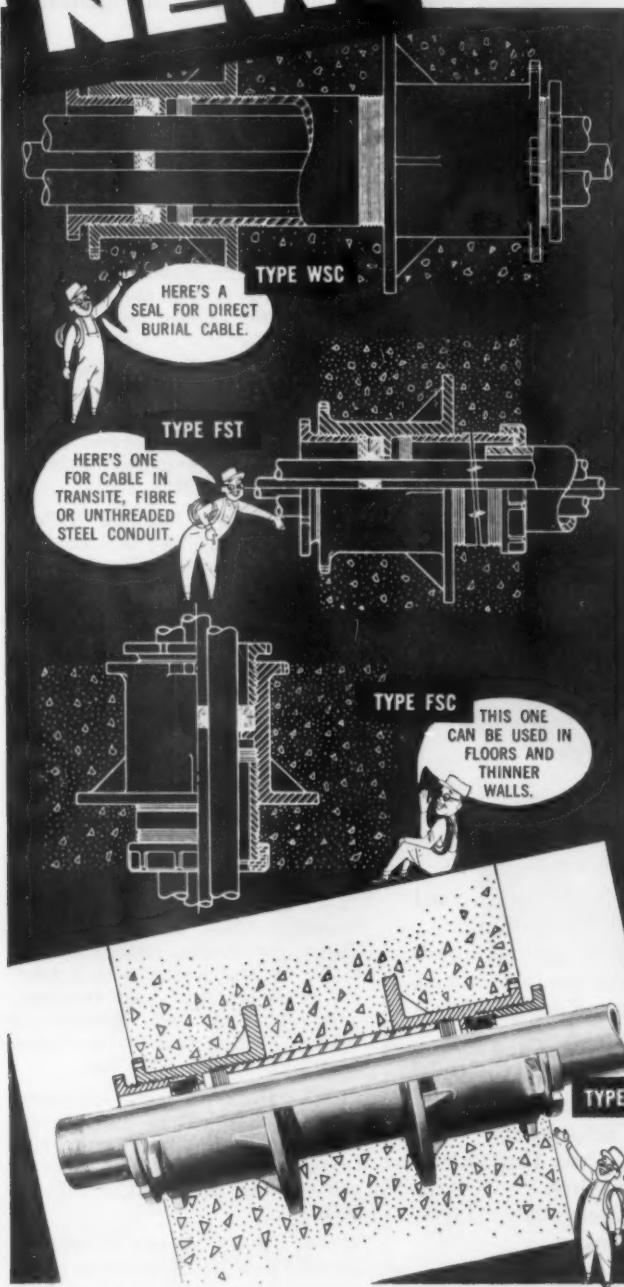
(93) **FLUORESCENT LAMP.** New F40 lamp for universal use in preheat or rapid-start fixtures with light output up 6% to 2800 lumens is described in Lamp Letter No. 59-86, with ordering and technical information. General Electric Co.

(94) **SYNCHRONOUS GENERATORS,** engine-driven, in all standard ratings at speeds from 150 to 600 rpm and 720 to 1200 rpm, are described in bulletin 05B6139B. Allis-Chalmers.

(95) **COUNTING INSTRUMENTS.** Catalog and price list covers electric counters including hermetically sealed and dustproof models, actuating switches, stroke counters, revolution counters, and others. PIC Automation Controls Div., General Controls Co.

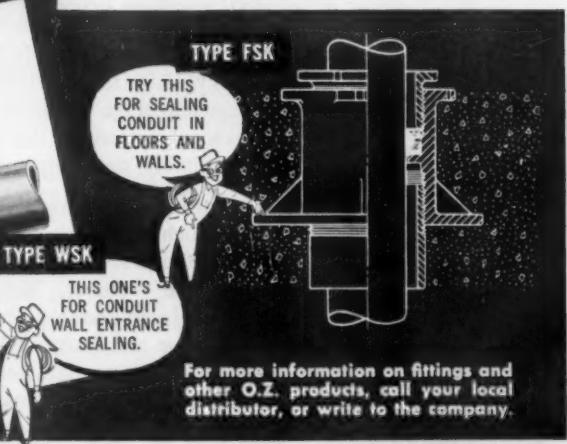
(96) **PORTABLE SWITCHES,** including pendant pushbutton station, attachable pendant toggle switches, side-mounted toggle switches, and standard pushbutton switches are described in bulletin. Joy Mfg. Co.

NEW!



a complete line of O.Z. WATERTIGHT ENTRANCE FITTINGS for Conduit or Cable

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(97) AC CONTACTORS, oil-immersed, are described in bulletin 14B8752. Units are rated at 400 amps, 5 kv, 50 mva, mounted in small tank, for operation in hazardous, corrosive or dusty atmospheres. Allis-Chalmers.

(98) TERMINAL BLOCKS. Booklet describes Controlead heavy-duty, medium-duty and sectional type terminal blocks with typical list prices. Marathon Special Products Corp.

(99) WIRE AND CABLE. Simplified technical information giving prices, weights, diameters, insulation thicknesses, and specifications of line of wires, cables and power cords. Hatfield Wire and Cable Div., Continental Copper and Steel Industries, Inc.

(100) GARDEN LIGHTS. Garden and play area lighting equipment, including several new Floralites with fibre glass tops, are covered in two new pieces of literature, 135-59 and 1016-59. Steber Mfg. Co.

(101) ELECTRIC BRAKES. Bulletin 5000 describes Type WB dc magnetic brakes, with information on maintenance procedure and selection data for matching brakes to specific motors. Electric Controller & Mfg. Co.

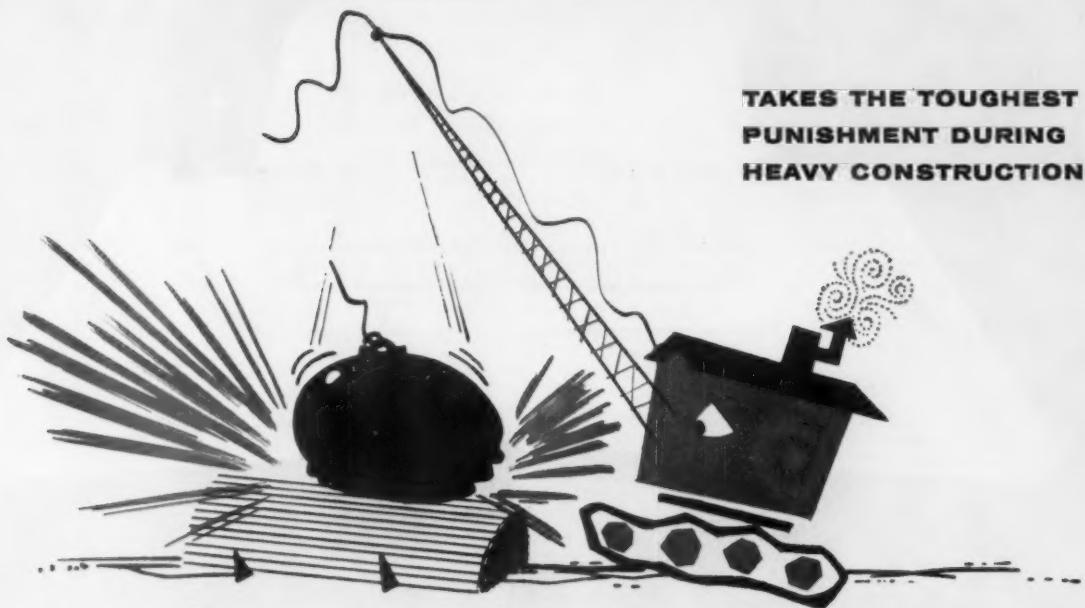
(102) PRECISION SWITCHES. New 28-page catalog 359 contains detailed information on expanded line of snap-acting switches for severe requirements, automatic devices and appliances, including variety of integral and auxiliary actuator styles. Unimax Switch Div., W. L. Maxson Corp.

(103) ELECTRIC HEATING. 33-page Booklet B-3768C contains series of charts for simple, reliable computation of heat losses, with a tabulation of practical heat transmission coefficients and formulas for solving heating capacity problems. Westinghouse Electric Corp.

(104) HIGH-VOLTAGE STARTERS. Bulletin 8130 covers starters for squirrel cage, wound rotor and synchronous motors on 2200 to 4800-volt systems. Electric Controller & Mfg. Co.

(105) SMOKE ALARM CONTROLS. Electric Eye unit intended to guard against damaging or panic-causing smoke circulated by air conditioning systems is described by Bulletin 553. Photomation, Inc.

(106) ANTENNA OUTLETS FOR TV and FM radio installations in residences are treated in 4-page catalog 58, describing kits available in two sizes for either two or four outlets. Mosley Electronics, Inc.



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FAIRVIEW

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Reader's Quiz

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Grounding an Ungrounded System Against Surges

QUESTION C36—I wish to establish a ground on an existing 3-phase 480-volt ac power system for elimination of surge voltages due to ground faults. What is the best and most practical method of doing this?—W.E.G.

ANSWER TO C36—The simplest and most economical method is to ground the corner of the secondary delta. This has one main objection, voltage-to-ground on the other two phases will be 480 volts. The other method is the use of grounding transformer, i.e., zig-zag, 3-phase, grounding transformer. Three single-phase transformers may be utilized (you may have on hand). With this system, the high side is connected star, neutral grounded, and the star connected to your lines. The secondary of this system is delta closed. The impedance of this system (impedance to ground) should be such as to permit sufficient current to flow through a fault to trip the breaker or blow the fuse and isolate the fault.—J.A.M.

ANSWER TO C36—If W.E.G. has a 480-volt 3-phase system which is "Y" connected, the simplest method is to ground the neutral of the "Y", either solidly, as is usually done for systems under 600 volts, or through a resistor or reactor. If he has a delta connected system, probably the best method of connecting to ground is by a zig-zag grounding transformer. The losses are chiefly due to magnetizing current, which is a small fraction of the system load current. The rating of a zig-zag transformer required to carry short circuit current is relatively small.—R.W.K.

ANSWER TO C36—I would say that when it is desired to ground existing delta-connected low voltage systems, a grounding transformer should be used to form a neutral, which is then connected solidly to ground. Further information as to type and size required for such an application can be obtained from any reliable transformer manufacturer.—D.S.V.

Measuring 3-Phase Power with Two 1-Phase Wattmeters

QUESTION D36—When two single-phase wattmeters are measuring power and power factor on a 3-phase circuit, are meter readings adversely affected if power is received at a low power factor?—G.J.P.

ANSWER TO D36—In any wattmeter there is a difference in phase between the current and voltage elements which will produce an error which is greater for low power factor, and will require the application of a correction factor. When two single-phase wattmeters are used to measure power in a 3-phase 3-wire circuit, there is an additional effect resulting from the method of connecting the current and potential coils to the system. With this connection, the power is given by the algebraic sum of the readings of the two wattmeters. If the power factor is less than 50%, the deflection of one of the wattmeters will be negative, and to obtain a reading it will be necessary to reverse either the current or the potential connections of that instrument. The reading of the reversed wattmeter must be subtracted from that of the other to give the total power.—B.F.S.

ANSWER TO D36—The use of two single-phase wattmeters for measuring power and power factor on a 3-phase circuit is quite satisfactory and independent of the power factor of the load. However, the readings on these wattmeters depend a good deal as to whether there is any unbalanced loading. With unbalanced loading on a 3-phase circuit it is quite possible to get a set of readings which, in reality, are completely false as to the power or the power factor taken. In fact, in one case where the writer happens to know the situation rather well, a single phase load is deliberately connected across the 3-phase system to adjust the wattmeter readings so that they give a figure which is acceptable to the utility providing the power. There is only one thing to watch for when using a balanced load and low power factor, and that is to make sure that both wattmeters are reading in the same di-

rection. When using the system for low power factor measurement, it will be found that one wattmeter reads backwards, and the actual power drawn is the difference of the indications, rather than the sum. I have assumed throughout that the proper voltage and current are impressed on the wattmeter coils.—H.H.S.

DC Plugging For AC Motors

QUESTION E36—What are the advantages of dc plugging of a 3-phase ac motor over ac plugging? Which imposes the least severe conditions on the motor and which is the recommended method for fast stops?—J.M.

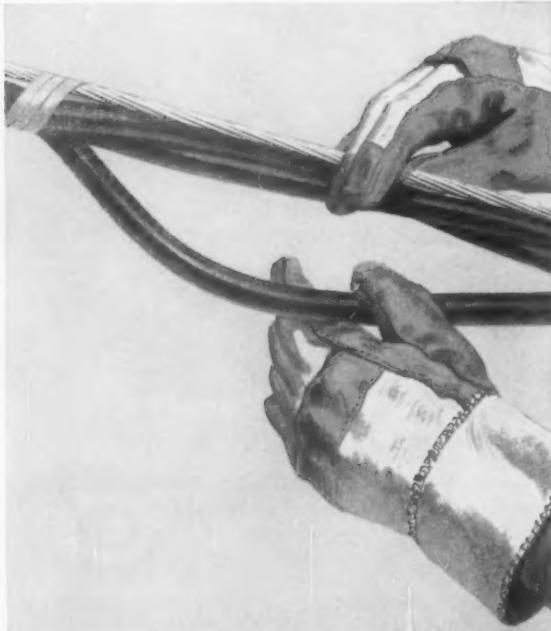
ANSWER TO E36—Regarding the advantage of dc plugging over ac plugging, I would say that dc plugging minimizes the shock to the motor. Furthermore, there is no possibility of overrunning. When using ac plugging, what we effectively do is to try to reverse the motor, and thus we apply a tremendous surge of ac current. In order to make sure that the motor does not run backwards, a special type of rotary switch is used. However, if this switch should fail, it may be that the motor will run backwards, and this may have disastrous results. With dc plugging this is not possible, as the motor will not run with dc.

Another point about dc plugging is that it is possible to control the rate of deceleration by varying the dc current to the motor. It becomes rather hard to do this with ac plugging.

Frankly, the writer is not happy with either dc or ac plugging. I believe that in both cases this puts too much of a stress on a motor, and wherever possible, I would recommend that brakes be used rather than plugging. There are available today excellent air-operated and magnetically operated brakes from a number of manufacturers. These brakes can be adjusted to go into operation at an extremely fast rate, yet will give very smoothly controlled deceleration. A further advantage is that the brake draws

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SIMPLE CONNECTIONS

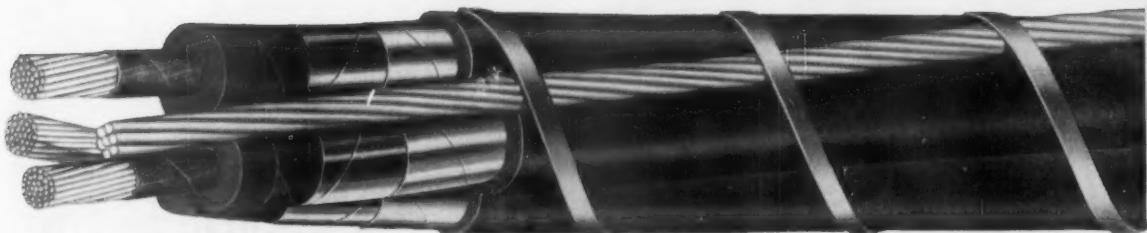
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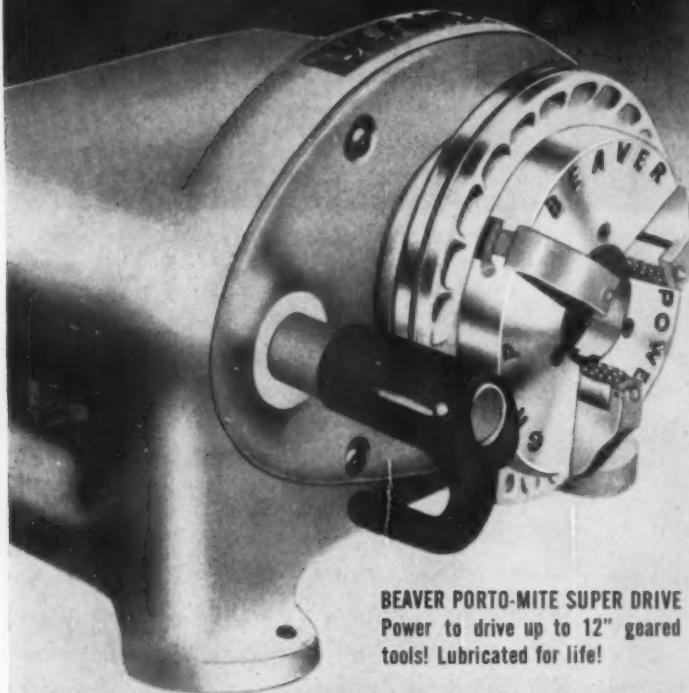
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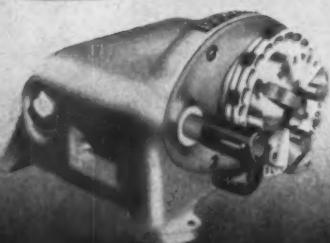
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only a small amount of control current, and therefore, will not burn contacts, etc. Furthermore, the small amount of control current lends itself admirably to automation, that is, programming of starts and stops, several control points, etc.—H.H.S.

ANSWER TO E36—Some advantages of dc plugging or braking of ac induction motors versus ac plugging thereof are: (1) much less heating of motor, (2) more powerful braking action down to about 10% speed, (3) braking torque easily varied with a rheostat. Westinghouse Electric, and some other companies, make crane controls using dc braking. Hence, they could answer quantitatively any questions on this subject.—R.W.K.

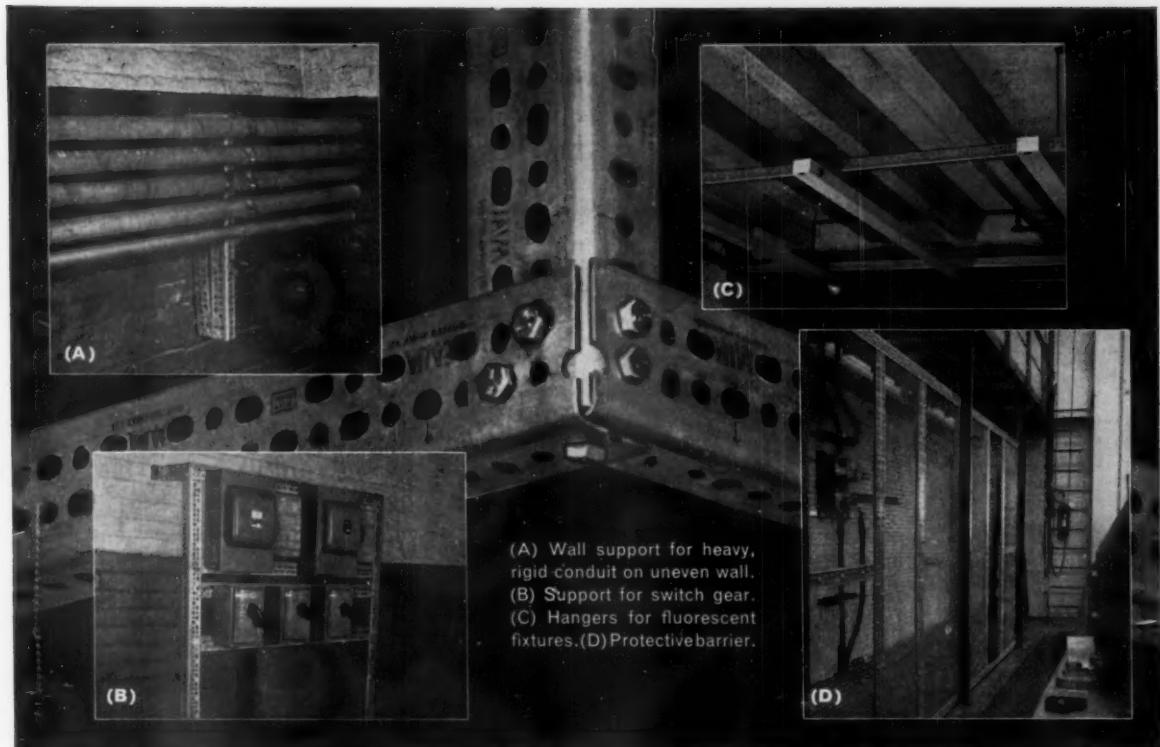
Tabulated Data on Short-Circuit Currents

QUESTION F36—Where can we obtain graphs or tables to use in determining short-circuit currents at a particular fault in circuits in the 110- to 18,200-volt range in alternating currents?—S.G.F.

ANSWER TO F36—The only correct graph or table to fit a certain job can come from a recording ammeter for slow currents and from a neon lamp near a photographic plate in a dark place for high speed currents. These short circuit currents



AT RECENT CHAPTER Officers Conference of NISA in St. Louis were Cortland Worth, president of Niagara Chapter, Erie Electric Co., Buffalo, N. Y. (left); and John F. Neihart, president of Quaker City Chapter, Standard Electric Service Corp., Reading, Pa.



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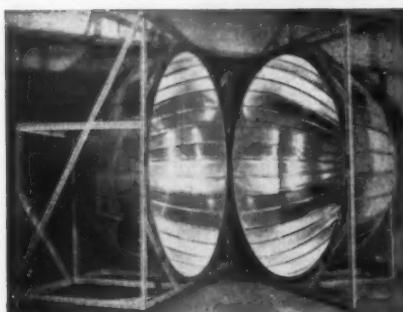
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A new, exclusive, slot-and-hole bolting pattern cuts installation costs, provides durable structural assembly and ease of apparatus attachment. Friction-Joints, easily formed by bolting through the slots, offer good rigidity. Bolting through the round holes gives you Lock-Joints for maximum strength and rigidity. All standard electrical fittings adapt to $\frac{3}{8}$ " holes; no reaming or special fittings needed.

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New AIM Brand Slotted Angle is adaptable to all kinds of applications, even such an unusual installation as this street light testing device.



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Duplex, Brown
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COMBINATION

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depend on the part of the cycle when it happens, and the load conditions.
—H.S.

ANSWER TO F36—I am sure that if S.G.F. will contact the following people he will get desired information etc. Mr. Eustace Soares c/o Pringle Elect. Mfg. Co., Industrial Eng. Service, 1912 N. Sixth Street, Philadelphia, Pa.; I.T.E. Circuit Breaker Co., 1900 Hamilton Street, Philadelphia 30, Pa. I also feel that GE or Westinghouse could also furnish desired information.—C.L.

**Can You Answer
These QUESTIONS?**

QUESTION P36—I have had two inquiries about a system of gas lighting which was used some years ago. This system used lump carbide and water, the water being fed as needed to the carbide where the gas was generated as fast as the load required, evidently with a pressure switch operated by the gas to open or close the water flow.

Would like to have any information from other readers who may have worked on some of these generators.—E.E.M.

QUESTION Q36—Where the frequency is O.K. but the wave shape of each cycle is not a sine wave, how can the wave shape be made into a sine wave to get better motor operation?—E.B.

QUESTION R36—The haulage system of our mining operation consists of one 13-ton, 250-volt, dc trolley locomotive remotely controlled from each ore chute by a P. B. Station which operates a panel mounted dc contactor to energize and de-energize the trolley line as each car is spotted at the chute for loading. This system necessitates leaving the locomotive controller two-thirds on. This in turn creates a problem of severe arcing of contacts at panel mounted contactor.

Would it be practical to install standard power capacitors of say 25 kvar each, in parallel across these contacts to reduce the severity of the arc? If so, approximately how many kvar of capacity would it require to attain effective results?

The contactor panel consists of two contactors connected in parallel. Would it be of any advantage to connect them in series?—A.A.N.

**PLEASE SEND IN
YOUR ANSWERS BY AUGUST 15**



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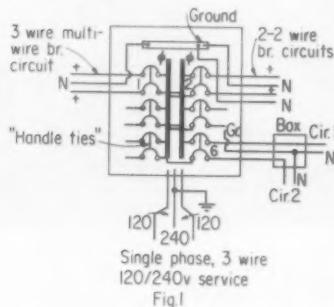
Questions on the Code

Answered by:

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.
B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

Service Disconnect—Handle Ties

Q. A question has arisen concerning the use of tie bars on a circuit breaker panel. A typical example would be a residence with 12 single pole branch circuits. Six sets of tie bars installed on the breaker handles would limit the disconnecting means to six operations and not necessitate a main disconnect. Please advise if this is in violation of the National Electrical Code.—D.F.



A. Section 2351-a of the code, covering the disconnecting means for services includes the following clause:

"Two or three single pole switches or breakers, capable of individual operation, may be installed on multi-wire circuits, one pole for each ungrounded conductor, as one multi-pole disconnect (where applicable, see Section 2353) provided they are equipped with 'handle ties' ——" making it practical to disconnect all conductors of the service with no more than six operations of the hand. The disconnecting means shall be of a type approved for service equipment and for prevailing conditions."

When the above conditions are satisfied, there is no occasion to install a main disconnect ahead of the circuit breaker assembly. It is significant to note that the two or three breakers, connected by a handle tie as one multi-pole disconnect, serves a multi-wire circuit. In other words two breakers connected to the same phase conductor could not be connected by a "handle tie."

In order to clarify the rule involved, I have shown by Fig. No. 1, 12 single-pole circuit breakers in-

stalled in a service panelboard served by a 3-wire, 120/240-volt single phase service. In order to obtain six means of disconnect, two breakers, each connected to different phase conductors, are equipped with "handle ties." Official Interpretation No. 448, issued early in January 1958 covers this point. It reads as follows:

"QUESTION—Is it the intent of Section 2351 to recognize as one of the disconnecting means, two single-pole circuit breakers on the same side of the line and controlling two 2-wire circuits?

"ANSWER—NO."

Circuit No. 1 shows how a 3-wire multi-wire circuit is served through two single pole circuit breakers equipped with handle ties acting as a multi-pole disconnect. This circuit fully satisfies in my opinion the letter and intent of the rule.

Circuit No. 2 shows two 2-wire branch circuits, with individual neutral conductors run direct to the grounded bus in the service equipment, served through two single pole circuit breakers equipped with "handle ties" acting as a multi-pole disconnect (each breaker connected to opposite sides of the line). This procedure has been criticized since the breakers do not serve a multi-wire branch circuit as inferred by Section 2351.

Circuit No. 6 shows a 3-wire multi-wire branch circuit may be obtained at a panelboard and immediately converted into two separate 2-wire circuits at a junction box immediately adjacent to the panelboard. This procedure would satisfy the rule which refers to multi-wire circuits, but it is difficult to understand the distinction in hazard which results when either circuit No. 2 or No. 6 is used. Official Interpretation No. 450, issued during May 1958, clarifies the code intent on this question. It reads as follows:

"Section 2351: Number of connections on the service neutral plate."

"STATEMENT:—12 single pole circuit breakers are equipped with handle ties or have the handles of adjacent breakers close enough so that six disconnects result. These six disconnects control six 3-wire, 120/240-volt branch circuits.

"QUESTION:—If the 3-wire

branch circuits are divided into 12 2-wire branches at the service by the provision of 12 instead of six connections on the neutral plate or bus, would this be in accordance with the intent of paragraph 2 of Section 2351?

"ANSWER—YES."

A summary of the foregoing indicates that 12 single pole circuit-breakers may satisfy the requirements for a service-disconnect when all of the pertinent provisions of Section 2351a are satisfied.—B.A. McD.—7/59/1

Motor Overcurrent Protection

Q. It is recognized and the code so states that code provisions are to be considered a "minimum" and the code is not to be considered as a standard.

a. With the above in mind, is it practical that a municipality take the "option" of the inspector out and make a mandatory provision that "three" overload relays be required instead of two in all 3-wire, 3-phase, ac grounded neutral; all 4-wire, 3-phase, ac grounded neutral or ungrounded neutral?

b. Would, or is such action warranted in a large metropolitan area?—W.W.

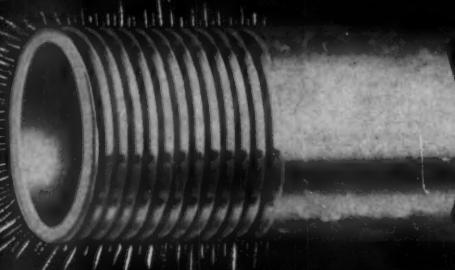
A. A municipality has the right to make any mandatory provisions or pass any ordinances provided these are within the scope of its charter, enabling act or any other legal authority given to the municipality. The National Electrical Code is only a legal document in so far as it is legally adopted by any municipality within the framework of its legal powers. The prime purpose of any ordinance, etc., should be the practical safeguarding of persons and property.

The answer to your second question is again a moot one. The code only points out in the fine print note of Section 4327 that a problem does exist and further recommends a solution. What action should be taken by a large metropolitan area certainly cannot be outlined by one who does not have all the facts and conditions. In fact, no one person, or even one group of persons, for

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example, the inspection group, or the utility group, or the contractor group, etc., could possibly evaluate all the factors satisfactorily to come up with a proper answer.

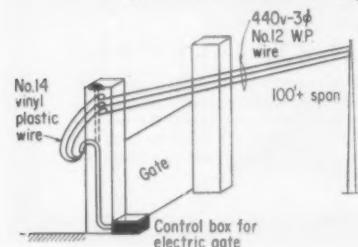
This problem has been recognized for many years. Many people have studied it and quite recently it has been given much publicity. Mr. Frank Johnson of the New Orleans Public Service, Inc. has made quite a study of this problem and presented a paper before the South-eastern Electric Exchange. As a result of this paper and subsequent discussions NEC Panel No. 11 has proposed that this fine print note be made mandatory in the 1959 Code. However, there has been quite a bit of discussion of this proposal and much opposition has developed to its adoption.

So my advice to any group contemplating any action at this time is to hold off for the present. The problem has been recognized. Many different interests are examining and studying the various facets of the problem. When the final answer has been evolved you can be assured that you will then have a code provision that will represent the best practical compromise available considering every phase of the problem.

For the present if you have any one particularly isolated case or cases which may be very "sticky" you can still resort to the prerogative offered to you by the fine print note in Section 4327 to take care of these for the present without sticking your chin out with some action you may be sorry for at some later date.—B.Z.S.—7/59/2

Service Heads— Outside Wiring

Q. We are running 440-volt 3-phase power to an electric power driven gate. We took off from a deep well pump house for our power source and ran overhead some 100 ft to the gate. Both gate posts are about 4 ft higher than the gate proper. The chief electrician intended to come from the overhead to a half-inch pipe which he had bent in a gooseneck without any



protection for the wire from phase fault or the weather. A sketch of the situation is shown here. I maintain that a service head should be used. What is your opinion?—J.A.J.

A. The provisions of Section 3008 of the code read as follows:

"Except as provided in Section 3009, a box or terminal fitting having a separately bushed hole for each conductor shall be used wherever a change is made from conduit, electric metallic tubing, non-metallic sheathed cable, armored cable or Type MI cable and surface metal raceway wiring to open wiring or to concealed knob-and-tube work. A fitting used for this purpose shall contain no taps or splices and shall not be used at fixture outlets."

This general code provision would, in my opinion, cover the case in question even though the installation is outside. In fact, it appears that an outside installation would be more concerned than an interior installation.

According to Section 2337 service conduit shall be equipped with a raintight service head with conductors of opposite polarity brought through separately bushed holes. A gooseneck is only recognized for use with service cable and then the wires must be taped and painted and held in place by its connection to the service-drop conductors. These rules only apply to services, but in the absence of specific rules covering the case in question they form a pattern of good practice for all outside installations. I am unable to find under Article 730, covering outside wiring, any specific reference to the subject, although the provisions of Section 7341 require conduit on the exterior of buildings to be made raintight and suitably drained. To me this implies that a service head or an entrance cap must be used. The code does not recognize a gooseneck, formed on a conduit, to satisfy the provisions for a raintight job.

In connection with your diagram, it is significant to note that the provisions of Section 734b of the code require the overhead conductors to be not smaller than No. 8 for spans exceeding 50 ft in length.

Section 2337 requires the connection of service entrance conductors to the service drop conductors to be at a point above the level of the service head. As shown by your diagram, water, during a rainstorm, could enter the conductors at the

splices and travel down to the control box. This, of course, is a service rule but one which should be recognized on all outside wiring. As a result the conduit should be brought up to a point just above to highest conductor as shown by the dotted lines on your diagram.—B.A.McD.—7/59/3

"RR" Insulation

Q. Can Style RR wire which is listed by Underwriters' Laboratories, Inc., as Type RH-RW be pulled in conduit for an interior raceway system?—H.B.

A. According to the Table in Section 3102 of the code, a Type RH-RW insulated conductor is recognized for use with any of the applicable wiring methods of Chapter 3. As a result, such an insulated conductor is recognized for use in conduit for interior wiring. The manufacturer's designation "Style RR" indicates that it has a neoprene jacket, in addition to a high moisture-resistant insulation. It has been recognized by U.L. as a Type USE cable, suitable for direct burial in the earth. In such instances however the code designation "USE" should appear on the conductor. In all cases the code designation identifies the insulation, and when a conductor is listed by U.L. as type "RH-RW," its use is restricted to that recognized by the code for such a type of insulation.—B.A.McD.—7/59/4



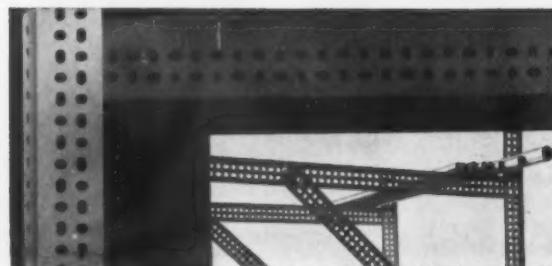
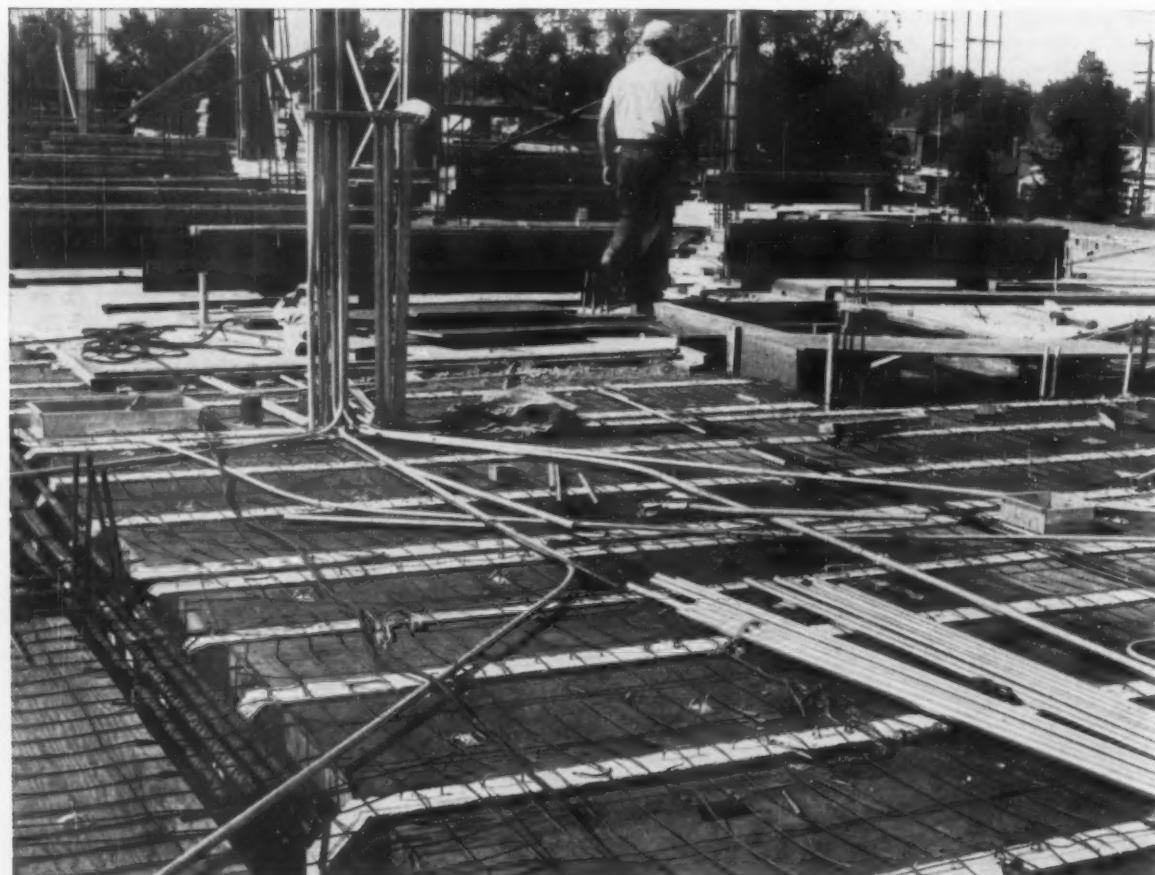
CONSULTING ENGINEER Irv Drucker of Drucker & Associates, Chicago, checks over remote lighting control system he helped design for a recently completed southwest Chicago bowling alley.



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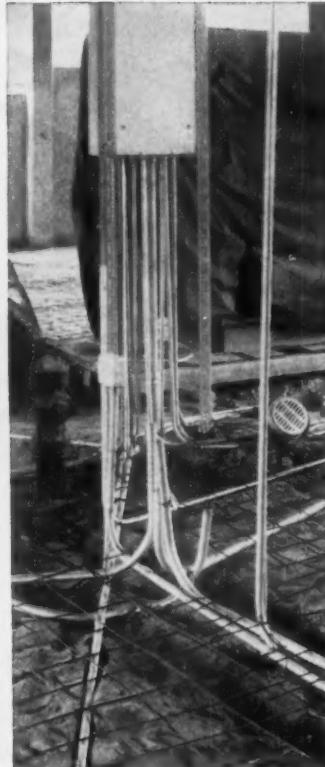
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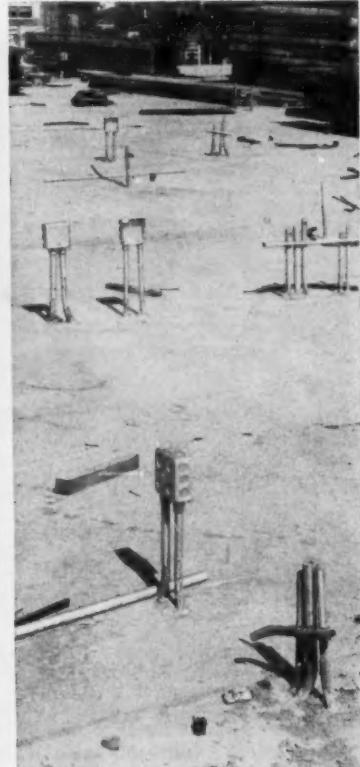
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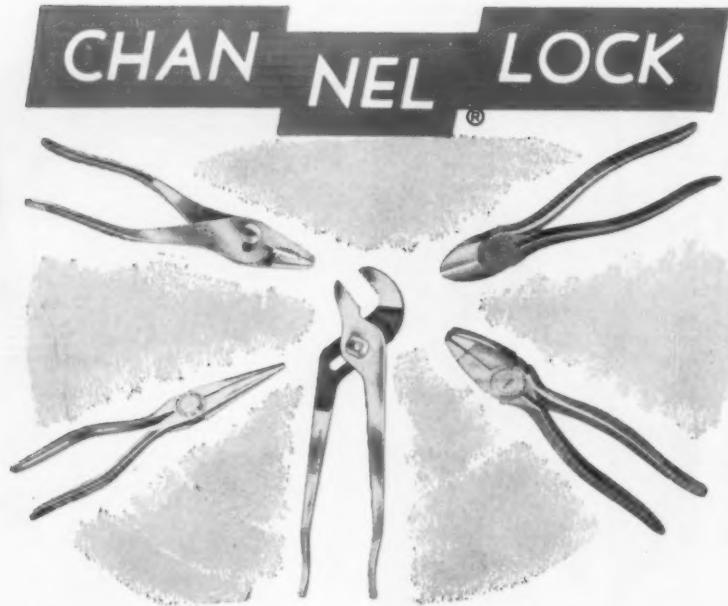
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**Bare Grounded
Conductor
Underground**

Q. Is it permissible to bury directly in the earth a bare copper conductor or an armored ground conductor? The bare will be used as a neutral and the armored ground will be used as a system and equipment ground.—R.C.M.

A. According to the provisions of Section 3019, "Conductors run underground shall comply with the provisions of Sections 2311, 2312 and 2312 as far as mechanical protection is concerned."

Section 2311 reads as follows: "Mechanical Protection. Underground service conductors shall be protected against mechanical injury by being installed in duct, conduit, in cable of one or more conductors approved for the purpose, or by other approved means. See Section 3102-b."

Section 3102-b. Conductor Insulation, Wet Locations. Insulated conductors used underground, in concrete slabs or other masonry in direct contact with earth, in wet locations, or where condensation or accumulation of moisture within the raceway is likely to occur, shall be moisture resistant, rubber covered (Type RW); moisture resistant, thermoplastic covered (Type TW); lead covered; mineral insulated-metal sheathed (Type MI); or of a type approved for the purpose."

Fine print note. "Such conductors are not suitable for direct burial in the earth unless of a type specifically approved for the purpose".

This code provision only concerns insulated conductors, and it is quoted to establish the fact that when a conduit or a cable assembly is used underground, particular attention must be given to the type of conductor insulation, and also the fact that neutral grounded conductors must generally be insulated.

The second sentence of Section 3102-b reads as follows:

"Cables of one or more conductors for direct burial in the earth shall be Type USE, except that branch circuit and feeder cable may be Type UF. If single conductor cables are installed, all conductors of each service, feeder, sub-feeder or branch circuit, including the neutral conductor, shall be run continuously in the same trench or raceway. Supplementary mechanical protection, such as a covering

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of board, concrete pad, raceway, etc, may be required by the authority enforcing the Code."

A summary of the foregoing rules indicates to me, as covered by Section 2311, that underground conductors, regardless of insulation, must be protected from mechanical injury. Such protection is considered satisfied when the conductors are installed in conduit, duct or in a cable, but when cables are used it may be necessary to provide additional protection from mechanical injury by coverings, concrete pad, raceway, etc, as covered by Section 3102-b. According to Underwriters Laboratories Type USE underground cable does not have inherent protection against mechanical abuse and when installed under driveways, parking areas, railroad crossings and similar locations, they should be protected from the crushing effect of weight by the methods covered in Section 3102-b.

Since the use of a bare neutral grounded conductor is restricted to services, when the voltage to ground does not exceed 300 volts, it appears that the provisions of Section 2303 are primarily concerned with your question. At the present time, the status of a bare neutral installed underground in direct contact with the earth is rather vague, and while I believe the above quoted rules could be interpreted to prohibit such use, past field experience indicates that such procedure has been accepted. In order to specifically cover this question a proposed revision of Section 2303-b has been unanimously accepted by Panel No. 3 for inclusion in the 1959 edition of the code. It may be subject to further revision before final action is taken in 1959. It reads as follows:

"Section 230-30 (2303-b)

"PROPOSAL: Consider bare conductors in the earth. Although permitted by code for many years, questions recently raised concerning bare grounded copper conductors buried directly in ground. No specific failures or trouble with such conductors have been reported to the Panel. There have been reports from certain areas, of deterioration of galvanized piping and other ferrous metals buried in the earth in the vicinity of exposed copper. Bare aluminum generally considered unsuitable for underground.

"SUBMITTER: Merwin Brandon.

"PANEL RECOMMENDATION:
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A—Underground conductors up to the point of attachment to service equipment shall be covered with rubber, cambric, thermoplastic, paper or other approved insulating material, except:

"Exceptions:

No. 1. Uninsulated grounded neutral conductors of aluminum or copper may be installed underground when part of an approved cable assembly.

No. 2. Bare grounded neutral conductors of copper may be installed underground in duct or conduit.

B—Insulated service conductors installed underground, or in concrete slabs or masonry in direct contact with earth, shall be lead-covered or of other types specially approved for the purpose.

"INTERPRETATION NO. 447

"PANEL COMMENT: Agree with Interpretation that code did not prohibit bare conductors in direct contact with the earth. Based on reports, however, of corrosion resulting in other structures where bare copper conductors were buried directly in the soil in proximity with dissimilar metals, the above change in Section 2303-b is now recommended.

"PANEL VOTE: Unanimous."

In addition to the foregoing, I am quoting an answer to a similar question given by the late Glenn Rowell in the January 1957 issue of E.C.&M.

"Under Section 1110 of Article 110 you will find the following wording: 'Unless approved for the purpose, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes vapors, liquids or other agents having a deteriorating effect on the conductors or equipment; nor where exposed to excessive temperatures.'

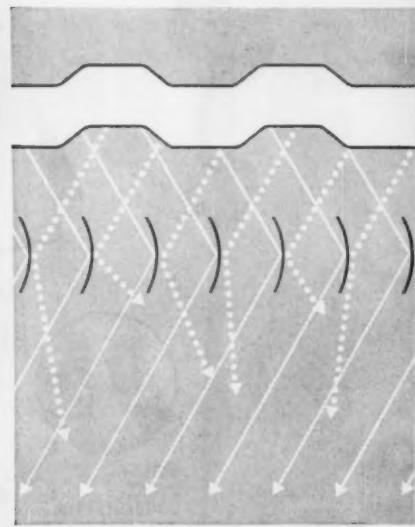
"Inasmuch as most soils contain some form of decaying vegetable matter or some other chemical which is injurious to copper, the use of a bare conductor as part of an underground circuit would be in violation of this section unless an analytical test of the soils in which this bare copper conductor was buried indicated that soil was free of any deteriorating agencies. It is true that in certain types of locations bare copper conductors will not be affected by soil acids or alkalies. The most common instance where this is true is on street lighting circuits contained wholly under paving or sidewalks where the soil consists largely of sand or very light loams. Experience on airport lighting has indicated the serious



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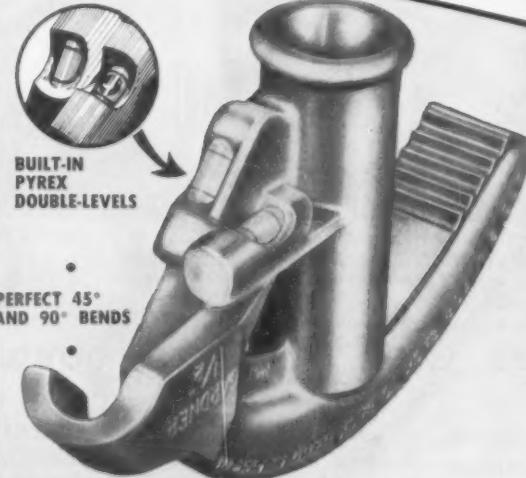
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necessity of not using bare copper conductors until such times as an analytical test of soil proves it safe as there are actually instances where conductors have been eaten through in less than two years' time."

Insofar as the armored common grounding conductor is concerned, I do not believe there is any code violation when installed underground. The provisions of Section 2592 covers the question of mechanical injury and while there is no specific provisions for underground use, it appears that the armor would satisfy most installations. A grounding conductor does not normally carry current. As a result the undesirable corrosion feature which promoted the proposed revision of Section 2303-b does not normally exist when an armored grounding conductor is run underground in contact with the earth. Under certain soil conditions the armor and possibly the copper conductor could deteriorate. It appears however that this factor is not specifically covered by the code.—B.A.McD.—7/59/5

NEC Official Interpretation

Another interpretation of a section of the National Electrical Code has been reviewed and released by the NFPA Electrical Correlating Committee. Its effective date is March 17, 1959.

Subject of this interpretation is the application of Tables 11 and 13, Chapter 10, NEC, to the conductor fill required when rewiring existing raceways.

Official text of the interpretation follows.

INTERPRETATION No. 454

NEC CHAPTER 10, Tables 11 and 13

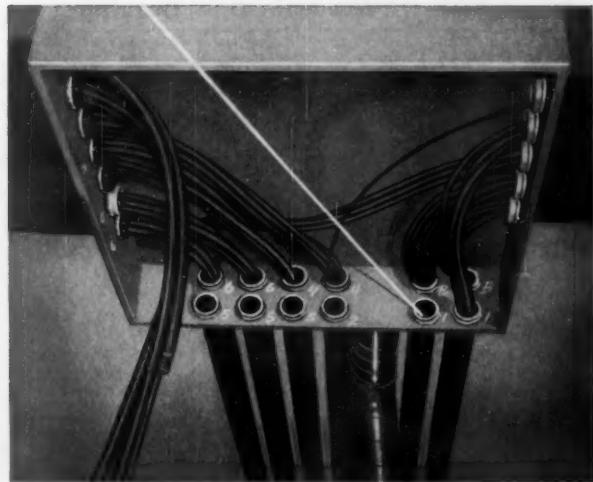
Statement: For the rewiring of existing raceways, Table 11 permits a 50% fill where it is impractical to increase the size of the raceway due to structural conditions. Also, the fine print note under Table 13 permits the use of the actual cross sectional area of Type TF, T, TW, RU, RUH, and RUW for calculating the fill for rewiring existing raceways, while in new work the larger dimensions for Type RW apply.

Question: Is it the intent to permit both of these exceptions simultaneously for rewiring?

Answer: Yes.



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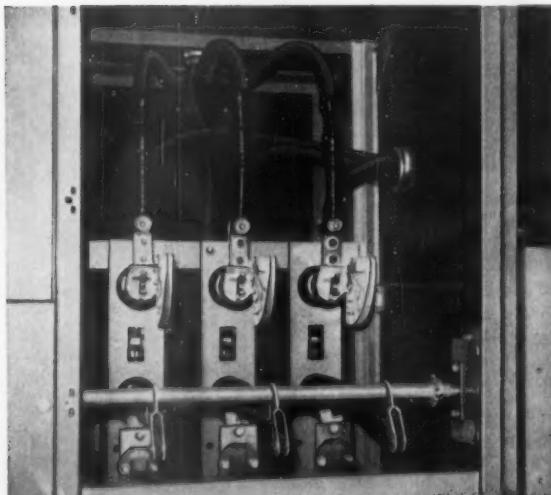


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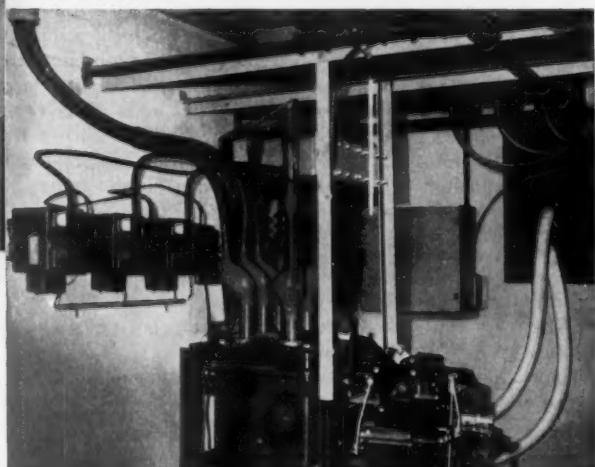
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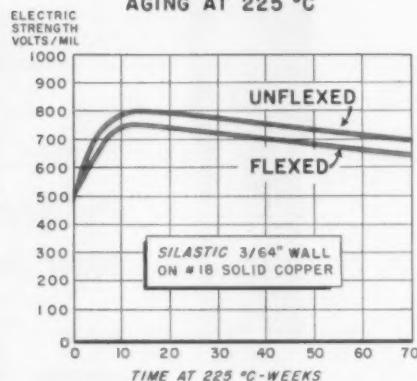


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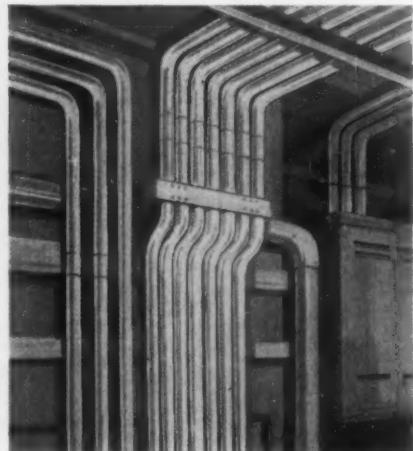
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In the News

NISA Convenes In Montreal

Modern materials, methods and management are major topics in lively speeches and panel forums.

Nearly 1,000 members and guests attended the 26th annual—and first international—convention of the National Industrial Service Association in Montreal, Canada, May 18-20. Business sessions were aimed at the many technical and management interests of the 1,600 NISA electrical service and sales firms in Canada, the United States, Cuba and Mexico. And an extensive manufacturers' exhibition of equipment and materials used and sold by electrical service shops was a popular feature of the convention.

At this convention, Horace C. Blenkhorn, president and general manager of Blenkhorn and Sawle Ltd., St. Catherines, Ont., was installed as president of the NISA.

Other officers elected included: J. Arthur Turner, Jr., Tampa Armature Works, Tampa, Fla., vice-president; Carl Lundberg, Cascade Machinery Co., Seattle, Wash., treasurer (re-elected); and M. G. Miller, Sr., Tennessee Electric Motor Service, Knoxville, Tenn., secretary.

The convention program was full and varied. The morning of each day was devoted to a general session at which noted speakers addressed the convention on all phases of repair shop operation. Each afternoon was devoted to a number of panel forums on specialized topics, such as: large motors, transformers, management, insulation and small motors. On the last afternoon,

a chartered bus tour was made to some of the outstanding motor service shops in the Montreal area.

Highlights of the general session addresses were as follows:

J. Herbert Smith, president, Canadian General Electric Co., Ltd., Toronto, delivered the keynote address at the opening general session. Pointing up the extremely important role the electrical service industry plays in keeping industrial production at its peak, Mr. Smith urged NISA members to equip themselves to meet their heavy responsibility. He advised increased emphasis on professional management within service organizations. This includes careful planning, both short and long range, organizing, integrating and measuring.

Secondly, he urged increase attention to the ever-increasing technical demands for skill and



FORUM PANEL on large motor problems included: (L to R) W. J. Engle, T. B. MacCabe Co., Philadelphia, Pa.; Frank Fenwick, Montreal Armature Works, Ltd., Montreal; J. Arthur Turner, Jr., Tampa Armature Works, Tampa, Fla.; Norman Finnie, Ampere Electric Co., Ltd., St. Catharines, Ont.; W. H. Braunlich, Braunlich-Roessle Co., Pittsburgh, Pa.; Robert Sandman, Sandman Electric Co., Boston, Mass.



MANAGEMENT FORUM panel members included: (L to R) William Palmer, Palmer Electric Co., Stamford, Conn.; V. A. Bradley, Jr., Bradley's Motor and Armature Works, Corpus Christi, Texas; A. G. Bamford, Sutherland-Schultz Electric Co., Ltd., Kitchener, Ont.; E. W. Wirtanen, Wirtanen Electric Co., Ltd., Edmonton, Alta.; and Gerald Schaeffer, C. I. Schaeffer Electric Co., St. Louis, Mo.



T. M. Paul, Paul Electric Co., Sioux City, Iowa; G. A. Amundson, H. A. Holden, Inc., Minneapolis, Minn.; Malcolm Logan, Rocky Mountain Electric Service, Durango, Colo.; J. C. Wagner, Electric Motor Service Co., Cincinnati, Ohio.



Stanley Romanoff, Romanoff Electric Motor Co., Toledo, Ohio; W. R. Lugar, F. W. Kiemle Co., Toledo; J. C. Nelson, Berger Brothers Electric Motors, Inc., Rochester, N. Y.; Wm. Waller, Jr., F. W. Kiemle Co., Toledo, Ohio.



W. E. Ziegenbein, Chicago, Ill.; A. J. Ebling, Ebling Electric Co., Chicago, Ill.; E. W. Henry, Henry Electric Co., Saginaw, Mich.; M. Z. Borinstein, J. E. Berger Corp.; Detroit, Michigan.



C. S. Moran, Standard Electric Motor Works, Detroit, Mich.; P. D. Bogdan, Clement Electric Co., Inc., Grand Rapids, Clark Mesler, Consolidated Elect. Co., Inc., Grand Rapids, Mich.; J. F. Dudley, Dudley Electric Works, Flint, Mich.



H. L. Phillips, Southern Electric Service, Charlotte, N. C.; Robert Sandman, Sandman Electric Co., Boston, Mass.; P. Nofzinger, Standard Electric Service, Reading, Pa.; Stanley Lewars, Lewars Electric Service, Lebanon, Pa.



Harvey Sullivan, Bennett & Emmott, Edmonton, Alberta, Canada; Henry Allmaras, Tires Electric Co., Long Island City, N. Y.; H. W. Englemann, J. L. Hemphill and Co., Inc., North Bergen, N. J.; Stanley Bojak, Standard Electric Motor Repair Co., Linden, N. J.



thorough knowledge to handle the increased complexity of electrical products and systems. In particular, this requires an expanded program of training for new personnel in the service industry. Mr. Smith noted that NISA recently began a program of presenting scholarships to technical institutions for awarding to junior or senior engineering students of the schools' own choice.

"The need for technical training on the job for these new recruits as well as your present staffs cannot be over-emphasized. The introduction of static switching for fast response control systems, dry rectifiers for rotating sources of direct current, electronic programming control for machine tools and systems of machines in automated plants are just a few examples of the flood of new products and systems you will be called upon to service in the years immediately ahead.

"It is too late to start studying the service needs of these products after your customer has called on your organization for help. It is essential that your people be fully up-to-date technically on the kinds of special equipments in your customers' plants. This calls for very close relationship between your or-

ganizations and those of your customers. In addition, the manufacturer carries a responsibility for providing the kind of data necessary for servicing his products and for the training of your technicians to do the work."

Transformer Design

Recent developments in transformer design were analyzed with respect to repair considerations by W. G. Seline, manager, Ferranti-Packard Electric, Ltd., Toronto. Confining his discussion to distribution and small power transformers up to 5000 kva, Mr. Seline talked about design changes of the last 10 to 15 years.

The most important design development, according to Mr. Seline, has been the use of cold-rolled, grain-oriented steel. This design advance in core steel has affected overall transformer design in a number of ways:

1. The core section has been reduced. Where formerly flux densities ran in the order of 60-72,000 lines per square inch, with oriented steel these have gone to 100-110,000 lines.

2. The number of turns of copper and hence copper weight has been

reduced as a direct result of (1).

3. Corresponding reductions in tank size and oil volume have been realized.

4. Losses have been reduced.

5. Total weights have diminished as much as 50%.

As a result of the foregoing, Mr. Seline pointed out, "There has been a basic change in the economics of transformer rewinding. The reduction in material and advances in manufacturing methods have kept the prices of new transformers reasonably stable during the past 10 years (in Canada). Hence a shop faced with rewinding an "old" transformer with a hot rolled steel core must put in approximately double the weight of copper required by a new unit. This makes it extremely difficult to compete against the price of a new transformer. Some utility shops are trying to overcome this by purchasing new grain-oriented cores and making a winding for same. Others are purchasing new core and coil units complete from the manufacturer and installing these in the old tank.

Other transformer design facts he noted are:

- a. Bushings are now generally of the stud type.
- b. High voltage tap arrangements

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Gentlemen:

Please send me the complete story of National
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with changing material prices, and suggest
profitable resale prices—quickly. No obligation.

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Title _____

Company _____

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G. T. Wardell, Wardell-Thurston Electric Co., Buffalo, N. Y.; Alfred Elson, New England Mach. and Electric Co., Pawtucket, R. I.; W. G. Brush, Electric Motor Service, Birmingham, Alabama.



C. J. Ainsworth, Ainsworth Electric Ltd., Toronto, Canada; A. G. Bamford, Sutherland-Schultz Electric Ltd., Kitchener, Ontario, Canada; Henry Raab, Duke Electric Service, Hamilton, Ontario, Canada.

ments have been changed from the 3-4½% taps below normal to the new 1-4½% taps above and 2-4½% taps below normal.

c. Insulation systems have changed. Some manufacturers are not varnishing their windings, some are using pre-shellacked kraft layer insulation. This has resulted in very compact coils. Use of synthetic enamelled wire has further restricted space requirements.

d. New grain-oriented cores are sensitive to mechanical stress, eliminating clamping of the core. Instead coils are clamped and cores left free from pressure.

a. Oxidation inhibition is generally used in oil in distribution transformers.

f. Self-protected transformers—with built-in lightning arresters, primary fuses and secondary breakers—are increasing in popularity. Widespread use of such units will reduce the volume of repair business considerably.

g. Higher-temperature insulations in dry-type transformers—classes B and H—afford smaller size and better overload characteristics. However, they also have lower efficiency and higher heat.

Shop Equipment

J. Arthur Turner, Jr., vice president, Tampa Armature Works, Inc., described the basic requirements of a shop handling large motors. To profitably engage in the repair and rewinding of motors and generators having form-wound coils, slip ring rotors over 100 hp and dc armatures over 100 hp, a shop must have: suitable equipment, sufficient inventories for fast service, trained personnel and a volume of repairs to justify the investment and return a fair profit.

He set down a hypothetical equipment list, as follows:

1. A large truck—minimum size, 1½-ton flat bed truck—at a cost of \$2,400.

2. An overhead crane for in-plant handling. A modern 10-ton model sells at about \$1,500. But a 5-ton hand-operated chain hoist could be used. And an auxiliary hoist of 2- or 3-ton capacity would be necessary. The total installed cost of these items would be about \$2,000.

3. Other required equipment would include: large wheel pulley, rope and cable slings, large wrenches, a 30-in. lathe, balancing equipment, test equipment and electrical service large enough to test run the finished jobs. This might run around \$15,000, provided some equipment was picked up from the used machinery market.

4. Heavy-duty winding stand with a loop winding attachment adjustable up to 48-in. loop length and accessories for handling large field coils and small transformers. Cost—\$2,100.

5. Coil spreader—52-in. air operated model with air holders and air operated knuckle kickups. Cost—\$3,550.

6. Two taping machines for service on form coils. Cost—\$700.

7. Ovens with minimum inside measurements of 54-in. by 72-in. by 72-in. Gas-fired model cost—\$2,500.

8. Most large motor shops consider Sam Browning's double hydraulic coil press a necessity and not a luxury. Cost complete—\$1,640.

9. Wire reel rack, tension device, lead stripper and a thousand and one other items will cost another \$4,000.

10. Equipment for actual motor winding—a few armature stands, winding tables, large soldering irons, two 3-ton chain hoists, torches, etc.—costs about \$3,000.

11. The total equipment investment comes to \$36,890.

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Still the easiest operating switch on the market.

Sold only through electrical wholesalers.
Or for further information and prices,
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**this PLM catalog
speeds up ordering
and installing!**

You can wrap up details fast on splicing and terminating needs with this handy, up-to-date aid in planning and ordering.

The PLM line includes a complete range of splicing accessories for making 2, 3 or 4-way splices in or to armored cable (both open and sealed types), non-metallic sheathed cable and lead-covered cable through 23 kv. Unit package kits contain all materials and instructions needed for building correctly designed splice or termination.

Save time and work in getting correct materials to the right place at the right time. Ask for copy of PLM catalog 301. PLM Products, Inc., 3875 W. 150th St., Cleveland 11, Ohio.

PLM Terminators
Splicing Kits
Conduit Ventilators

William Hogue, Larsen-Hogue Electric Co., Los Angeles, Calif., discussed modern management techniques for electric service shops. He analyzed the cost and profit considerations and pointed up a logical procedure for keeping books and studying and adjusting financial matters.

Raymond H. Thielking, Schenectady Varnish Inc., Schenectady, N. Y., gave a highly technical and informative talk on developments in high temperature motor insulating materials. J. B. Toogood, Union Carbide Silicones Division, Tonawanda, N. Y., discussed developments in silicone insulation—silicone resins and silicone rubber. Henry J. Lee, Epoxylite Corp., El Monte, Calif., described the encapsulation of electric motors in epoxy resin formulations.

Horace B. Barks, Horace Barks Publications, St. Louis, Mo., discussed advertising and how it affects repair shop operations. After setting forth the basic need for advertising throughout the motor shop industry, Mr. Barks outlined an approach to advertising:

"Advertising, to be successful, must be backed by two things:

1. Money
2. Patience.

Therefore, to launch a successful advertising program, you must be prepared to spend money, and you must be prepared to wait for the results. Small businessmen who are cynical about advertising almost invariably base their disbelief on advertising experiences that were inadequately financed and that were prejudged."

After describing the various types of advertising used by many shops, Mr. Barks summed up as follows:

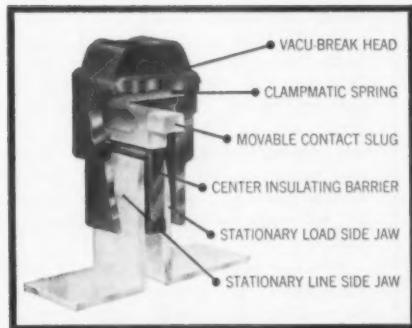
"If I have appeared to be critical of some of the advertising approaches in this industry, it is because I believe the advertisements that are the most factual, that are professionally prepared and packed with solid engineering data and information are the best. There are an increasing number of shops using this kind of material. What is needed is more of them!"

Concurrent Forums

Two afternoons of the 3-day convention were devoted to six concurrent forums with panel and floor discussions on the following subjects: large motors, small motors, insulation, transformers, management problems. Panel rosters and subject matter drew standing-room-only attendance.



Compact central power control—with Vacu-Break protection



VACU-BREAK CONTROL snuffs arcs immediately when breaking circuits under load. The enclosed head limits the oxygen available during the brief arcing period. Closeness of the head material causes the arc to cool and extinguish quickly. "Double-break" action reduces the distance the Vacu-Break head must travel before the arc is extinguished. In addition, Clampmatic action assures bolt-tight contacts, accelerates breaks.

BullDog Vacu-Break® Power Panels provide the efficient, economical way to centralize lighting and power distribution. One compact panel controls a host of lights and motors . . . saves space . . . provides real circuit flexibility.

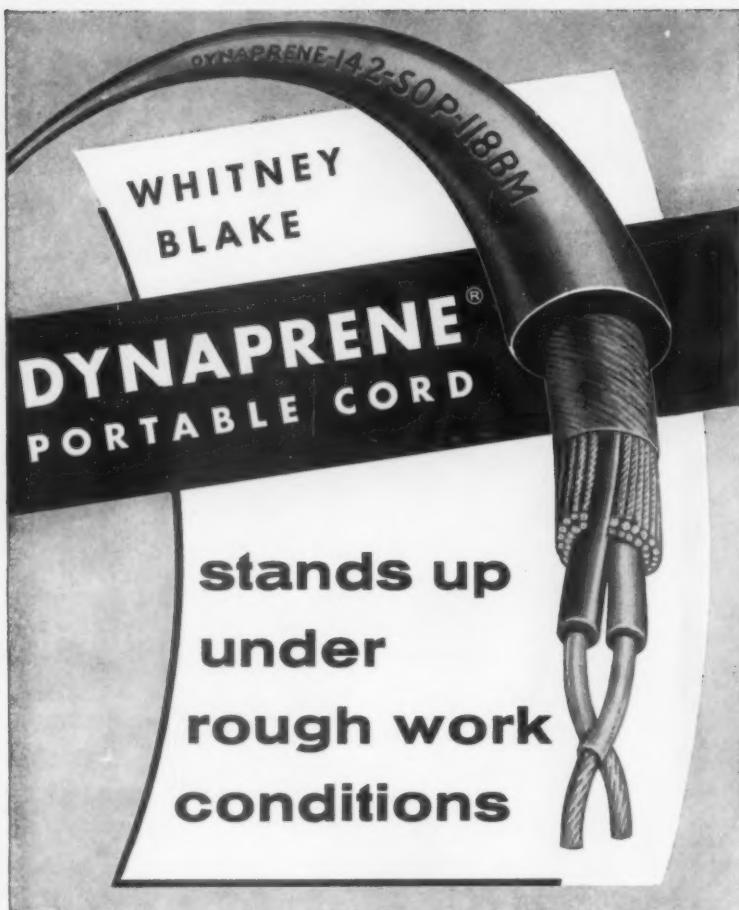
BullDog Power Panels are prefabricated . . . switch units are quick-make, quick-break, standardized and interchangeable. Units are available from 30 to 600 amperes. It is simplicity itself to convert the panels when circuit requirements change.

Exclusive Vacu-Break control snuffs arcs quickly . . . Clampmatic® action assures bolt-tight switching connections—longer equipment life. For safety's sake—and superior performance—specify BullDog Vacu-Break Power Panels.



BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
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In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.



Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.



Write TODAY
for this complete
catalog . . . FREE.



WELL BUILT WIRES SINCE 1899

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT

Pertinent facts gleaned from lively forum discussions included the following:

Collections—Losses on collection of accounts ranged from $\frac{1}{4}$ of 1% to 2% of gross sales. General consensus was to put a delinquent account on a C.O.D. basis after 60 days. If a note is taken for repair work, best assurance of payment is to turn note over to a bank and get your money. Experience indicates customers are more apt to pay the bank on time than the motor shop. The monthly statement plan is still one of the best ways to handle small customers and accounts. Some shops who have tried other techniques found better collection history when they returned to the statement plan. In general, it takes from 30 to 45 days to collect from larger companies. Best way to check prospective customer's credit is through local NISA Chapter (if such service is available) or through local chapter of National Association of Credit Men.

Price Cutting—Price cutting is a highly unprofitable method of increasing business volume. Ed Grant, Tennessee Electric Motor Co., Nashville, submitted this "food for serious thought": If you cut prices 5%, you have to get 18% more dollar volume or 25% more work to maintain the same profit as before; a 10% cut means 50% more dollar volume or 66 $\frac{2}{3}$ % more work; a 20% cut means 350% more dollar volume or 400% more work.

Pension Plans—One of the best ways to keep employees is to establish a good profit-sharing or pension plan. A number of shops are doing this to their advantage and to the benefit of their employees.

Sales Tax—Material and labor costs on repair work must be kept separately so tax can be applied to material used. Where this is impractical—as on small repairs or flat rate work—a good formula is to use one percent of billing price which generally adds up to about 3% of material cost on the specific job.

Pricing repairs—Most shops use Vaughan's pricing service as a basis with individual adjustments to meet local conditions.

Service Charges—Minimum service charges reported at the session range from \$6.50 to \$10.50 per hour depending on the type of mechanic sent out and the type of service work to be done. Cost of operating "trouble shooting cars" was reported as about 12 cents per mile. Don't be afraid to charge a reasonable rate for trouble shooting.

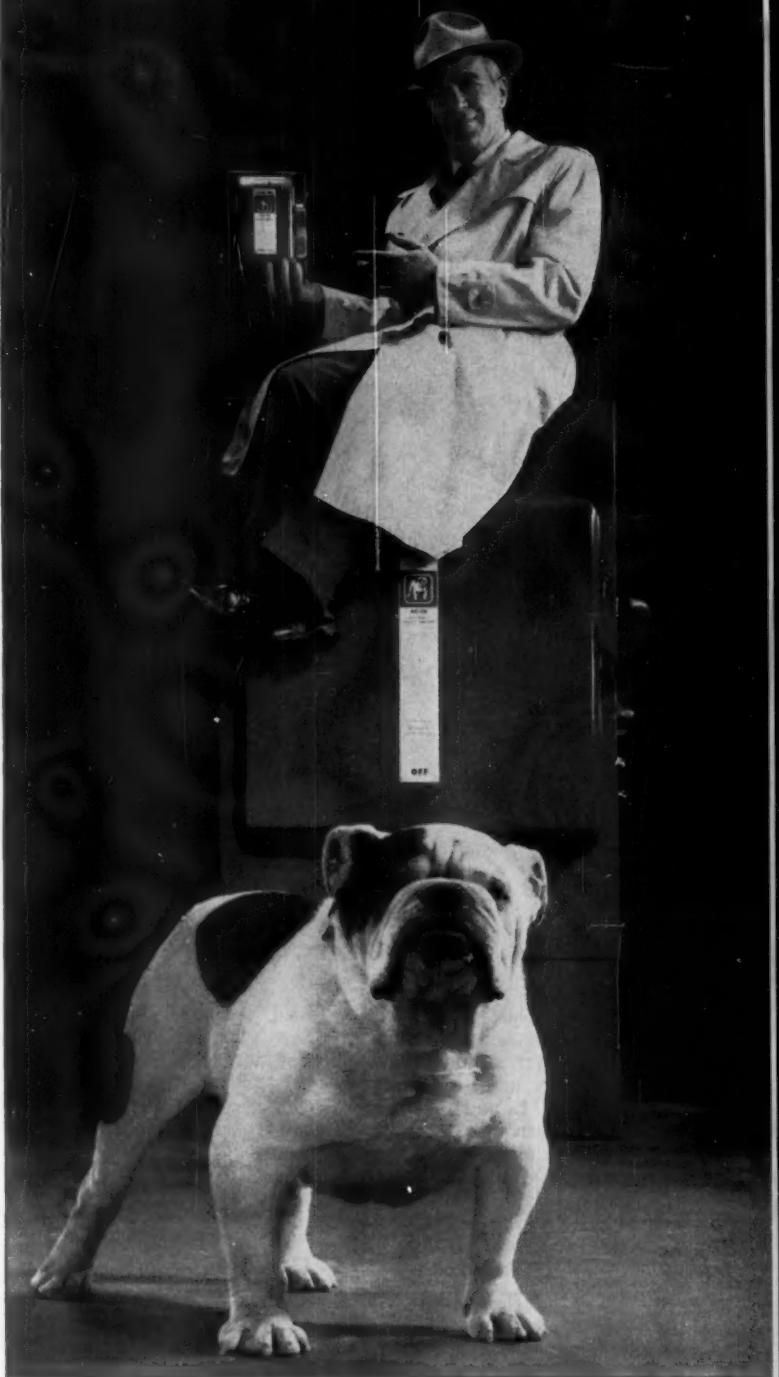
Safest switches known

-in every size from 30 to 1200 amps

Large or small, BullDog Clampmatic® Vacu-Break® Safety Switches provide *maximum* protection . . . meet most every switching need. They provide added safety because of these two exclusives: The unique Clampmatic spring increases the pressure against contact jaws . . . assures clamp-tight connections . . . faster break . . . *really safe operation*. Vacu-Break action snuffs arcs immediately . . . reduces pitting and burning of contacts for long, trouble-free switch life.

BullDog's "Big Three" safety switches, the "Master", "Junior" and "Rain-tight", assure positive switching . . . virtually eliminate costly maintenance. Give your customer this extra safety, extra performance now with BullDog Vacu-Break Safety Switches.

For
safety's sake
buy
Vacu-Break



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Fire detection is big business!

Cash in now with Kidde equipment!



For years, schools, public buildings, businesses and homes have been waiting for an inexpensive, dependable fire detection system approved by U.L. and F.M. Now you can sell them this vital detection system at a reasonable price. Whether you sell Kidde system components on an install-it-yourself basis, or do the actual wiring job, there are thousands of dollars in potential profits for you.

And, selling Kidde, you can be sure that you're selling quality. For more than 30 years, Kidde has been the leader in fire safety. It's a name you and your customers can trust!

Find out more about Kidde fire detection components — and how you can use them to cash in on these most profitable markets! For more information, write to Kidde today.

1. Kidde alarm bells—6", 8", and 10" diameter, U.L.-approved.

2. Kidde Fyrindex detectors. Self-resetting, fast-acting, easy to install. Fixed-temperature units each protect up to 225 sq. ft. Rate-of-temperature-rise models protect to 900 sq. ft. Combination rate-of-rise, fixed tem-

perature units each protect 2500 square feet. All U.L. and/or F.M. approved.

3. Break glass manual alarm. One or more stations.

4. Control, rectifier, zone annunciator panels contained in one cabinet. Monitors up to ten zones. 12 or 24 v., dc.

Kidde



Kidde Ultrasonic & Detection Alarms, Inc.
785 Brighton Road, Clifton, New Jersey

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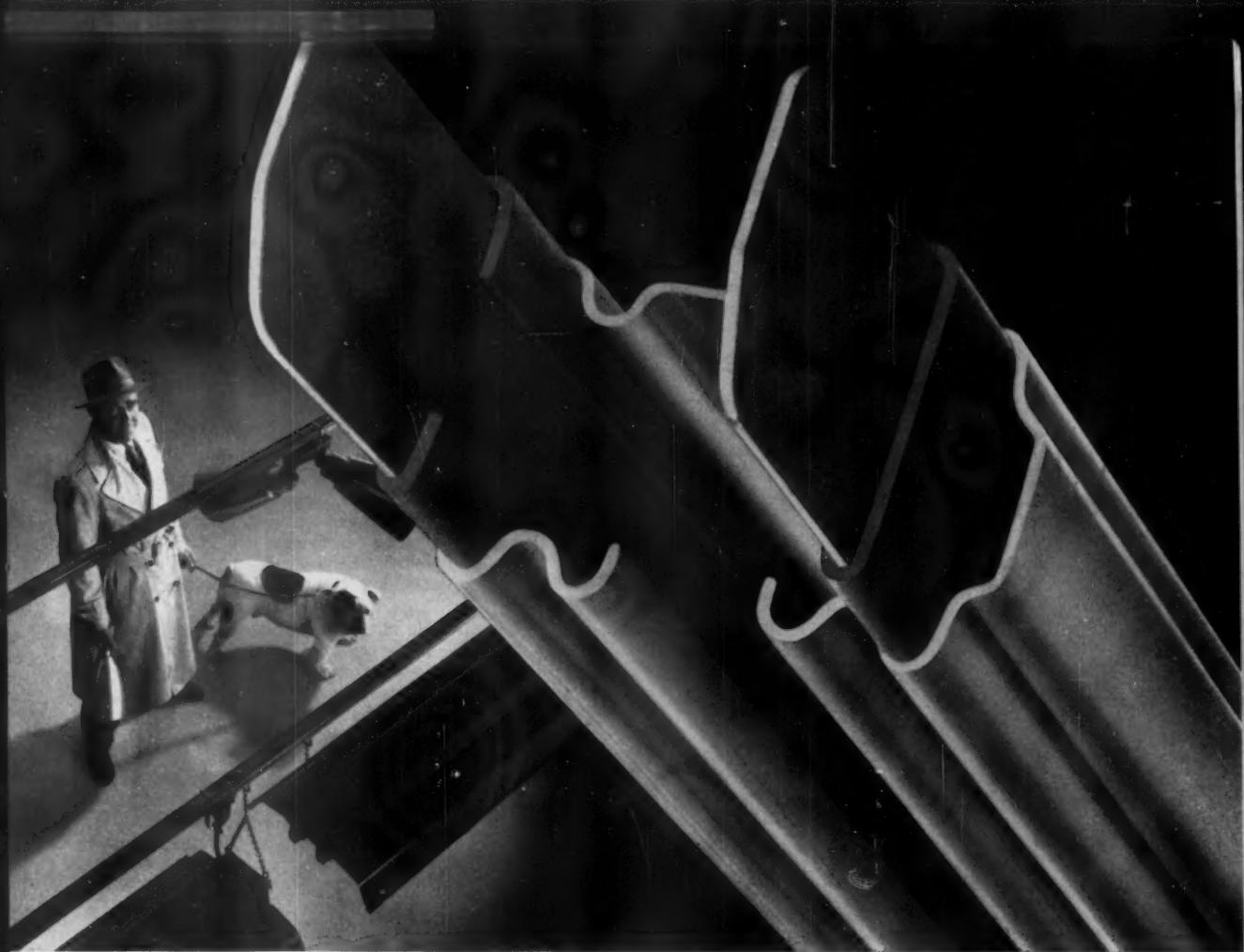
M. E. Assalone, Florida Electric Motor, Miami, Florida; F. Sloan, F. W. Sloan Electric, San Diego, Calif.; M. G. Miller, Tennessee Electric Motors, Knoxville, Tenn.

work, shop operators were told. Shop men experienced in this field noted that customers give less consideration to an hourly rate than to service rendered, particularly where plant down-time is an important factor.

Equipment Rental—Reasonable rental charges should be made for motors and equipment "loaned" to customers. Considerable interest was evidenced in a Rental Agreement Form published by the Central District Chapter, NISA, Chicago. Portable balancing equipment should be charged on an hourly basis for use of equipment plus an operator's charge. This approach permits rental of the unit with or without operator, as conditions warrant.

In-Plant Maintenance—Session members showed lively interest in this subject, particularly the experience of an Edmonton, Alberta shop that takes care of the total electrical requirements of a customer's plant. The shop works on a retainer basis plus a fee on labor and materials required; does all motor maintenance and repairing; offers 24-hour, seven-day availability of mechanics for trouble-shooting calls.

Epoxy Insulation—shops must keep up to date on developments and techniques in the epoxy insulation field because customers are beginning to request it on motor rewinds. Those who have used the epoxy method report rewinds on semi-enclosed motors run about double the cost of a Class-A insulation job. If possible, 5 or 6 epoxy rewinds should go through the shop at the same time. Others felt that silicone rewinds are just as good. All agreed to the wisdom of learning the precautions and techniques involved with epoxies and being prepared to meet customer demands in this respect.



BIDS ALWAYS "ON THE NOSE" WITH UNIVERSAL LIGHTING DUCT

*Exclusive BullDog features
mean faster, easier
installation that keeps
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Nothing makes it harder to figure lighting bids (particularly pipe and wire) than those unexpected—and expensive—changes you always run into after the job is started.

BullDog 20-amp Universal Lighting Duct licks that problem completely. You know in advance your final material and labor costs. So you can figure estimates—and profits—right "on the nose" before the job begins, instead of after it's over.

Changes in lighting arrangements

during installation present no problem since you can tap in anywhere along the entire length of Universal Lighting Duct. Moving outlet locations, or rearranging the layout, can be done without costly and time-consuming rewiring. With BullDog, you just move the exclusive "twist-out" plug to the desired new location in a matter of seconds.

ULD is actually less expensive to install than pipe and wire, too, because

it offers so many time-saving features . . . such as prefabricated parts . . . easily joined sections . . . choice of five installation methods . . . and the fact that it both feeds and supports the fixtures, thus eliminating the need for extra supports.

Join the growing list of contractors making money—and keeping customers happy—with ULD. For details, write BullDog Electric Products Co., Detroit 32, Michigan.



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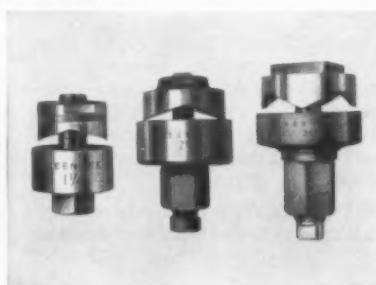
NEW...Ratchet Knockout Punch Driver... 6 times faster action



GREENLEE NO. 1804 RATCHET KNOCKOUT PUNCH DRIVER punches holes for $\frac{1}{2}$ " to 3" conduit 6 to 8 times faster than wrench method. Handy ratchet handle and special anti friction, fast-lead thread in the ball bearing assembly give fast approach and cutting action. One complete revolution of handle easily drives punch through 10-gauge metal. Lightweight . . . only $6\frac{1}{2}$ pounds. Use it with all standard GREENLEE Knockout Punches from $\frac{1}{2}$ " to 3" and Round Radio Chassis Punches $1\frac{1}{16}$ " and larger. Packed in strong metal carrying case with compartment for storing 2" and smaller knockout punches. May be purchased with or without punch sets. See-your distributor or write for Bulletin E-289.

Cut conduit holes quickly, easily with Greenlee Knockout Punches

Complete range of knockout punches to make openings for all standard conduit sizes $\frac{1}{2}$ " - 3". Fast, easy cutting through 10-gauge metal. Every cut is quick and clean — slug falls free in die. Hand, ratchet, or hydraulic driver operated. Wide choice of sets.



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BRI Holds Lighting Conference

Building illumination was the subject of a two-day conference held in Cleveland May 20-21, under sponsorship of the Building Research Institute, Division of Engineering and Industrial Research of the National Academy of Sciences, Washington, D. C. Attending this conference were nearly 300 representatives of the building industry, including architects, consulting engineers, lighting engineers, contractors, lighting equipment manufacturers, electric utility lighting engineers, office building managers and others associated with it.

The conference program was devoted primarily to the new recommended lighting levels for buildings, developed and approved by the Illuminating Engineering Society last year, and to the influence and impact of these new (and higher) lighting levels on cost, noise and heat control, architectural design, electrical system engineering, and other related factors.

The conference was opened with a keynote address on "New Opportunities in Building Lighting" by Fischer S. Black, publisher and editor of *Electrical World*. Adoption of new lighting levels for a wide range of seeing tasks by the Illuminating Engineering Society last year has raised a number of important questions among architects, engineers and other members of the building industry, Mr. Black said. This BRI conference was planned as a medium to explore and discuss these problems in considerable detail. Mr. Black pointed out, however, that too much emphasis has already been put on these new levels as *high* lighting levels. They represent instead, he said, the mount of light that we really need to see properly, based on independent and sophisticated light and vision research. Some of the questions which have been raised by the adoption of the new lighting levels were pointed out, and some of the benefits to be expected were enumerated and discussed. In general, the new lighting levels, if designed properly for adequate visual comfort, provides a wonderful opportunity for the building industry, with the aid and cooperation of the lighting industry and allied groups to render a real service to mankind. All of the electrical industry is backing better lighting, he said, and reviewed some of the activities and national programs, sponsored by Edison



SPEAKERS at recent BRI Building Illumination conference in Cleveland included (l to r) Henry Wright, architectural consultant, who discussed "Light As Architecture," and Robert A. Nevin, chief electrical engineer, Sargent-Webster-Crenshaw & Folley, who discussed "Economic Factors Related to Higher Levels of Illumination."

Electric Institute, National Lighting Bureau, American Home Lighting Institute and others which have adopted the new IES lighting level recommendations.

Light and Vision Research

Following the keynote speaker, who set the theme for the two-day session, was Dr. H. Richard Blackwell, head of the University of Michigan's Vision Research Institute which conducted an investigation over a period of nearly ten years that resulted in a new basis for establishing required footcandle levels. Dr. Blackwell keyed his discussion to building industry professionals and technologists who are not familiar in detail with illuminating engineering, and gave a popular and easily understood description of the research, and of methods of making and tabulating data, which was subsequently provided to the IES Committee on Recommendations for Quantity and Quality of Illumination, for development of recommendations for new footcandle requirements for various specific eye tasks. Basically, Dr. Blackwell's studies included an analysis of visual performance in terms of the process of the visual assimilation of information from the environment. Subsequently laboratory data were interpreted in terms of "field factors," which would represent visual tasks as performed in actual practice. Finally, by using a special Visual Task Evaluator developed for the purpose, illumination levels were established for 56 practical visual tasks selected from industry which would provide an adequate level of visual performance for each visual task.

FAST, Lightweight Greenlee Hydraulic Benders for 1/2"- 4" Conduit and Pipe

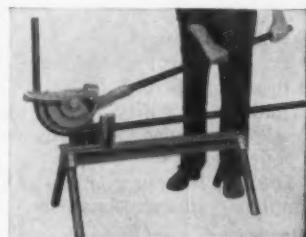


full 90° bend with one ram stroke

NEW GREENLEE No. 883 Lightweight Hydraulic Conduit Bender quickly makes accurate bends in eight sizes of conduit from $1/2"$ through $3"$. . . up to 90° with one ram stroke. Operates with either a portable power pump or hand pump. Makes 90° bend in $3"$ conduit in approximately 1 minute with power pump . . . only 10 minutes with hand pump. One set of rotating supports for all eight conduit sizes . . . supports also serve as rollers for wheeling bender from job to job. Conduit is easily inserted and removed from front of bender. "Quick-removal," positive-locking support pins cannot come loose. Bending gauge included for accurate results with minimum calculations. Get details now on the complete GREENLEE Lightweight Bender line that includes three models for $1/2"$ - $2"$. . . $1/2"$ - $3"$. . . and $1/2"$ - $4"$ conduit.

new, fast ratchet bender for $1/2"$, $3/4"$, $1"$ conduit

GREENLEE No. 1800 Ratchet Hand Bender permits short, powerful strokes for easy, quick bending up to 90° . Swing-away clamp makes loading simple. Sturdy T-iron base sets anywhere or receives threaded pipe legs of any desired length. Built-in bending gauge reads 0 to 90° . See your distributor for a demonstration, or write for descriptive Bulletin E-291.



A COMPLETE LINE OF HYDRAULIC AND HAND BENDERS FOR CONDUIT AND TUBING

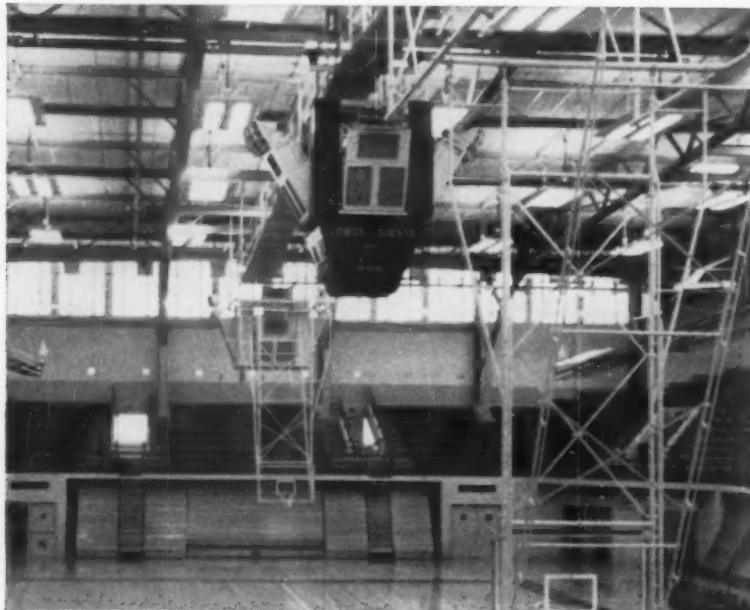
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IT TAKES A SPECIALIST LIKE STROMBERG-CARLSON

to provide an ingenious sound system
that meets multiple needs



In the new Roy Johnson Gymnasium at the University of New Mexico a Stromberg-Carlson sound system easily fulfills a wide range of specialized requirements.

The system provides superb voice transmission and full-range music distribution that make every seat "front row." An example of the ingenuity of the system is the installation in the glass-enclosed pool. Here two separate sound systems let the swimmers hear the spectators and be heard by them.

Quality, flexibility and ingenuity are at *your* service to meet the needs of your clients.

You can bid our equipment with complete confidence because:

"There is nothing finer than a Stromberg-Carlson"

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C. L. Crouch, Technical Director of IES, addressed the group following Dr. Blackwell, and described in detail how the technical committees of IES used the information provided by Dr. Blackwell's research to establish the new IES Recommended Levels of Illumination. Essentially, his discussion related to the bridging between research and actual practice. The idea of a "luminous environment" is catching on, Mr. Crouch said, and the focal point of such an environment is the visual task.

A panel discussion was held following the talks of Dr. Blackwell and Mr. Crouch, which related to the basic blackwell research and the IES development of the new footcandles. Panel members were: Dr. Blackwell, Mr. Crouch, Benjamin J. Wolpaw, M. D. (AMA Committee on Ophthalmology), and Charles D. Gibson, chief, Bureau of School Planning, California Dept. of Education. Murray L. Quin, senior director of research for Day-Brite Lighting, Inc., conference chairman, served as moderator.

The first day's afternoon session was devoted to demonstration of illumination levels and lighting design trends, which was conducted at the General Electric Company laboratories at Nela Park, Cleveland. These demonstrations embraced current and future practices of lighting for stores, offices, schools, factories, restaurants, etc., including homes; and installations of lighting levels of 450, 800 and 1,000 footcandles were shown.

New Lighting Problems

Sessions for the second day of the conference were designed to help architects, engineers and others to anticipate the impact of the new lighting levels on building design. The program included five speakers and an 8-man panel for the concluding discussion period.

Two speakers discussed "Trends In Light Source Development and Utilization." Electric light sources were discussed by Henry L. Logan, vice-president, research, The Holophane Co., Inc. Natural light sources (day lighting) were discussed by James W. Griffith, associate professor of engineering, Southern Methodist University.

Dr. Logan told the group that the new IES lighting levels can be obtained by existing tools, if properly selected and intelligently applied. He pointed out, however, that some light sources must operate in a rela-



LIGHTING SESSION on Problems of Correlation at recent BRI meeting on Building Illumination in Cleveland was participated in by (l to r): R. E. Fischer, associate editor, Architectural Record, who chairmanned the session; E. J. Benesch, chief engineer, Syska & Hennessy, Inc., who discussed "Effect of New IES Recommended Lighting Levels on Air Conditioning and Noise Control"; and Dr. Henry L. Logan, vice president, Research, Holophane Co., Inc., who discussed "Trends in Electric Light Source Development and Utilization."

tively narrow temperature range, and that for this reason there may be a need for mechanical refrigeration or method of cooling. He also pointed out that about 125 foot-candles of incandescent lighting, or 600 footcandles of fluorescent lighting, using currently available light sources, seems to be the limit before the need for correction to eliminate the discomfort from infrared radiation, or heat. He mentioned two solutions to this problem: 1) speed up the rate of air movement of the air conditioning system, or 2) lower the ambient temperature.

Use of 1500-ma fluorescent lamps presents a problem, Dr. Logan said, in that ballasts operate in excess of maximum allowable temperature when enclosed. He suggested that high-frequency operation of fluorescent lamps be considered as one solution to ballast heating.

Mercury lamps are increasing in use, commercially as well as industrially, Dr. Logan stated, since a light output of 55,000 lumens per lamp is now available, as compared with 15,000 lumens per lamp for the largest fluorescent lamps.

Mr. Griffin described current practices of daylighting and the techniques being used to provide uniformity of lighting throughout an interior; also techniques used for shielding against sky glare and direct rays of the sun. By means of color slides, he showed a wide range of exterior treatments of school buildings, in which light-colored ground (or paved) areas were

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used to reflect light into school-rooms to light the ceilings, which in turn diffuse light in the room, and in which shielding against glare is accomplished by means of overhangs, horizontal or vertical louvers, venetian blinds, shades.

E. J. Benesch, chief engineer for the engineering firm of Syska & Hennessy, Inc., New York, discussed the "Effect of New IES Lighting Levels on Air Conditioning, and Noise Control." Included in his discussion were the actual lighting and air conditioning requirements for a 50-story office building now under construction in New York City, which was planned for 55 footcandles, and the calculated design requirements for lighting and air conditioning for 50, 100, 150 and 200 footcandles in a mythical 20-story office building. His studies indicated that lighting levels of 50 and 100 footcandles can be obtained practically based on currently generally accepted practices of design. But for lighting levels of 150 and 200 footcandles, air conditioning design becomes a more difficult problem, he said. One design approach is to use high velocity air movement, but this increases the noise level. Mr. Benesch provided actual design details for each specified condition, and concluded by recommending that serious thought be given to water cooling for lighting equipment used for lighting levels of 150 footcandles and above.

A discussion of "Economic Factors Related to Higher Levels of Illumination" was presented by Robert A. Nevin, chief electrical engineer for the architectural firm of Sargent-Webster-Crenshaw & Folley. His discussion was based on cost tables which he developed for a range of lighting levels using a variety of types of light sources and luminaires. He used a common denominator of "Cost per footcandle" and "Cost per sq ft" for each separate combination of light source and luminaire. In practice, Mr. Nevin stated, cost is a highly practical consideration, as many projects must be kept at a minimum cost, or they will not be built. Generally, he said, when lighting can be considered as a "production" tool, as in a factory, higher costs for lighting can be sold, but when lighting costs are budgeted as an overhead expense, as in small offices, schools, etc., higher lighting costs will not, in general, be tolerated.

Light sources are a prime factor in costs, Mr. Nevin said. Thus the lighting engineer must make sev-



CONTESTANTS in the IES East Central Regional Conference's MMLJ Commercial-Industrial Lighting Competition, held in Baltimore, Md. early in April, were (l to r): Capital Section—Mark Harris and Albert A. Fox (Joint entry), School of Foreign Service, Walsh Memorial Bldg., Georgetown University; Philadelphia Section—Paul F. Kyack, Church of the Nazarene, Pitman, N. J.; Pittsburgh Section—Armand Zatelli, Social Club Meeting Room, American Legion Post No. 5, Pittsburgh; and Maryland Section—Leo Rutherford, Auditorium for General Electric Appliance Warehouse, Baltimore. Winners were: First Prize—Armand Zatelli; Second Prize—Paul F. Kyack; Third Prize—Mark Harris and Albert A. Fox.

eral "trial calculations" to determine which light source will be most economical under a given set of conditions. High frequency fluorescent lighting systems, he said, usually will provide better lighting for the same money, but good judgment is important in the selection of a lighting system for any project.

Henry Wright, well known architectural consultant and formerly managing editor of *Architectural Forum* discussed "Light As Architecture." Lighting "is" architecture, Mr. Wright stated. Gradual improvement in electric lighting techniques over the past quarter century, has revolutionized the design of many types of buildings, almost without our realizing it, he said. Also, in "bringing the outdoors in" with big windows, the architect has "turned the inside out," thereby gaining a dramatic design device which requires extremely high-level illumination to be effective. Large windows do not eliminate the need for electric light, but accentuate it, he said. Electric lighting is a principal factor today in determining the "mood" of many building interiors, and now has much to do with the esthetic and emotional impact of such spaces.

The architect cannot possibly become an expert lighting technician—acquire and maintain familiarity with available lighting equipment and precise details of application. For these, he must rely on the lighting designer, illuminating engineer and electrical engineer, Mr.

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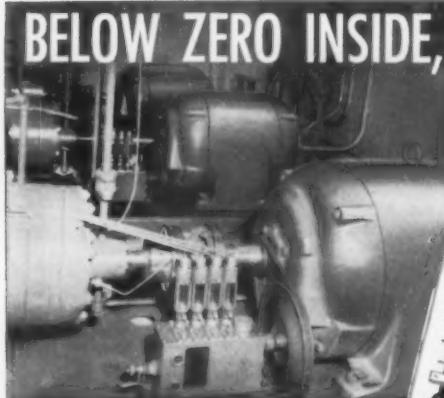
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Wright declared. But the architect must maintain close supervision of the lighting design in order to control the appearance of the lighting equipment, and to integrate that equipment with other parts of the building, he said. A number of slides were used to illustrate how lighting has been used effectively by architects as a part of their overall architectural design.

The concluding session of the conference was a panel discussion, moderated by Walter Sanders, College of Architecture & Design, University of Michigan. Panelists included the five speakers of the second day sessions, plus Robert E. Fischer, associate editor, *Architectural Record*, chairman of the sessions; John J. Neidhart, application engineer, The Miller Co.; and John McLaughlin, vice president, Kelso-Burnett Electric Co. Questions were submitted on cards in writing, and provided material for discussion for more than an hour.

Sponsors for this BRI conference were 15 lighting equipment companies, all members of the Building Research Institute. These were: Columbia Electric & Mfg. Co.; Corning Glass Works; Day-Brite Lighting, Inc.; General Electric Company; Edwin F. Guth Co.; Lightolier Co.; Miller Co.; Owens-Corning Fiberglas Corp.; Rohm & Haas Co.; Silvray Lighting, Inc.; Smithcraft Corp.; Sunbeam Electric Co.; Thomas Industries; John C. Virden Co.; and The Wakefield Company.



TWO CONSULTANTS and two electrical contractors cornered all four prizes in this year's Division 2 MAMIL contest sponsored by the IES Golden Gate (San Francisco) Section. Pictured above are Warren G. Smith of Smith Electric, who finished second; Robert Lee (Buss) Sawyer, Jr., of Pacific P&G (who won the Residential Division award); Jerry Ets-Hokin of Ets-Hokin & Galvan, who received fourth-place recognition; Charles H. Krieger, electrical engineer, who finished third; and L. G. Dehrer of Buonaccorsi & Murray, consulting engineers, who "took all the marbles" in Division 2 and will therefore enter the finals at this year's annual IES Technical Conference in Sept.



POUNDERING OVER proposed amendments to the National Electrical Code between sessions of the Illinois Chapter, IAEI, meeting held in Chicago recently are: G. E. Zisterer, Inspector, Cicero, Ill., (right) and L. Kirly, Inspector, Champaign, Ill. (left)

Illinois Inspectors Hold Spring Meeting

The 29th midyear meeting of the Illinois Chapter, IAEI, was held at the Hotel Faust, Rockford, Ill., May 21 and 22. Code discussion sessions, plus talks on electric heating, testing facilities at Underwriters' Laboratories, results of a home inspection program, and a resume of changes in the 1959 Code formed the nucleus of the two-day program.

Progress of the 1959 edition of the code, plus a brief review of a few of the more important changes were told by Frank Stetka, field engineer, National Fire Protective Association and editor of the revised code scheduled for publication around the middle of September.

Rockford's Fire Chief, Wayne Swanson, listed the results of a home inspection campaign carried on by his men. The program was developed and initiated by Chief Swanson in cooperation with the Rockford Electrical Inspection Bureau and the Central Illinois Electric and Gas Company. Its main purpose was to point out the various types of fire hazards found in the city's residential occupancies and to educate the public on fire prevention. Swanson stressed the fact that two of the most common violations uncovered by the firemen-inspectors were: (1) overfused service entrance equipment; (2) improper use of extension cords. The major results of the home inspection program cited by the Fire Chief were: (a) an increase in electrical work for the city's contractors; (b) a decrease in fire loss



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Some annoying power interruptions are due to inadequate wiring. A vast number are due to nuisance tripping of circuit breakers or nuisance fuse blowouts.

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Bulletin 158



for the homes included in the program; (c) passing of a new City Ordinance requiring all new residences to have a minimum of 100-amp service entrance.

The purpose, advantage, present state and future growth of electric heating was the basis of a slide-talk presented by W. G. Glos, vice president, Fred I. Tourtelot Co., Chicago distributors for electric heating equipment.

David W. Just, associate managing engineer, Inspection Control Dept. Underwriters' Laboratories, Inc., presented an interesting and informative color film on the various processes used at the Labs for testing materials for combustion, flame spread, fuel contribution and smoke output developed.

Electrical Contractor Heads Pacific Coast Association

C. A. Wikle, president of A. S. Schulman Electric Company of Los Angeles, was elected president of the Pacific Coast Electrical Association during that organization's 3-day convention held in San Francisco May 20-22. The gathering, attended by 1300 contractors, consulting engineers, utility representatives, manufacturers and distributors, was also highlighted by a full program of practical conference and business sessions; the theme for the meeting being "Let's tackle our problems—now."

In this endeavor, C. H. Bartlett, Westinghouse vice president, analyzed Technological Progress and Its Effect on Future Profits; James H. Goss, General Electric vice president, suggested some Fresh



BUSINESS PROBLEMS were widely discussed among those attending the recent NISA convention in Montreal, Canada, including: (l to r) Elmer Jandt, C & H Electric Co., Chicago, Ill., and A. C. Roe, NISA Office Staff, St. Louis, Mo.



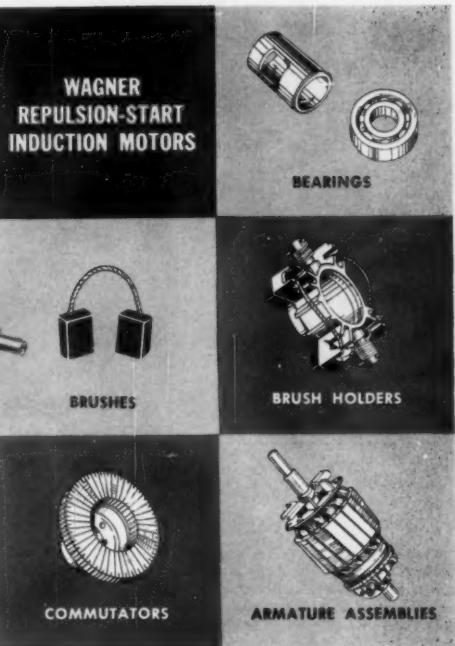
C. W. WIKLE, president of A. S. Schulman Electric Co., Los Angeles, was elected at the recent convention of the Pacific Coast Electrical Association to direct the activities of that industry-wide organization for the year beginning July 1, 1959.

Starting Points for Tomorrow's Selling, and Don G. Mitchell, president of General Telephone & Electronics, and chairman of the board for Sylvania, offered numerous ideas related to Getting a Bigger Share of the Consumer's Dollar.

Bartlett, commending the electrical industry for its record of reducing prices of products during a prolonged period of inflation, maintained that the next objective must be to further expand the use of power and to achieve a better balance between winter and summer peaks. Since 1930, he said, power requirements in industry have jumped from a thousand to 3,000-kw per operator, and improvements in turbines and generators have made it possible for utility systems to add capacity in units of 400,000 kilowatts instead of 60,000, which was the maximum size in the 1920s. Other savings are coming from the increased use of extra high voltage transmission lines, improvements in distribution transformers, power circuit breakers and related switch-gear, while the field of atomic power, the commercial development of thermoelectricity, automatic control and better system planning are some of the many areas where even greater improvement can be achieved in the future, he concluded.

James Goss, who heads up his company's consumer product group, discussed numerous new electrical appliances which are being introduced or developed to improve our living standards in the home. He proposed a revolutionary wiring change to encourage higher electrical

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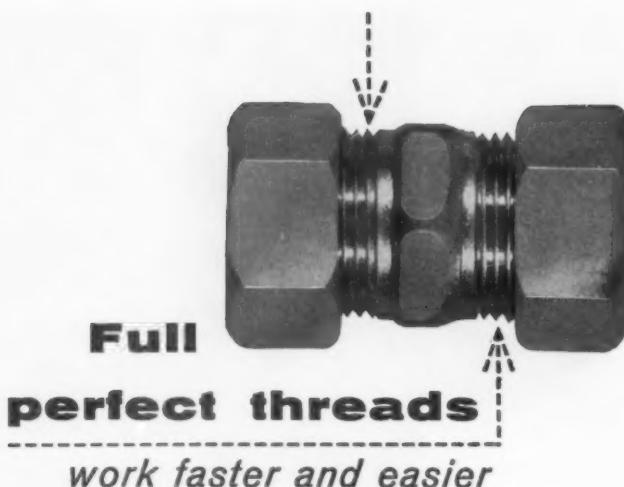
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NISA MEMBERS in attendance at the 26th annual and first international NISA convention in Montreal included: (l to r): Anthony Ingram, T & C Electric Co., Brooklyn, N. Y.; N. B. Swartz, Thos. C. Miller, Inc., N. Y., N. Y.; Fred Jussen-hoven, Monitor Electric, Brooklyn, N. Y.

cal consumption, suggesting that (like telephone companies) utility companies might profitably install and own entire electrical systems up to and including branch circuit panels in the home. He suggested that such installations be regulated and limited in an orderly pace by first offering rewiring to those customers purchasing 240-volt appliances, such as electrical ranges or dryers, and whose existing service entrances are not adequate.

Don Mitchell, predicting a record growth in the nation's productivity, declared that a realistic projection of today's demands would increase the GNP from its current rate of \$465-billion to at least \$600-billion by 1964 and to \$750-billion by 1970.

Only one booby trap can upset these predictions, he continued, listing that as inflation. He cautioned that if labor takes all productivity increases in the form of wage increases, there will be nothing left to plow back into business, and if industry simply passes along increased costs by raising prices, inflation will go still higher. And, if government keeps on financing deficits, there soon will not be anything left for anybody to finance.

Constantly increasing taxes and inflation are tools being used by socialists who advocate government control of ownership, added J. K. Horton, president of the Southern California Edison Company, who pointed out that the electric power industry already is paying 25 cents of every dollar earned for taxes, and that privately owned utilities are facing government-subsidized competition which is virtually tax free. Today we have a political environment that encourages labor to seek wage increases in excess of productivity gains; that seems to reject thrift in favor of deficit spending;

that sees nothing unfair with four out of five Americans paying 23 cents in taxes in every dollar of his electric bill while the fifth fellow pays only 2½ cents, he added.

Still another warning came from George M. Dean, vice president and general manager of the Pacific Telephone and Telegraph Company's Northern California area, who declared that creeping mediocrity is a greater potential threat to business than creeping socialism. Stating that developing leaders for tomorrow is the most important job of modern organization, he maintained that business needs men with many different combinations of strength and skill, and that trying to develop a "uniform product" or "an organization man" was not in the interest of this essential diversity.

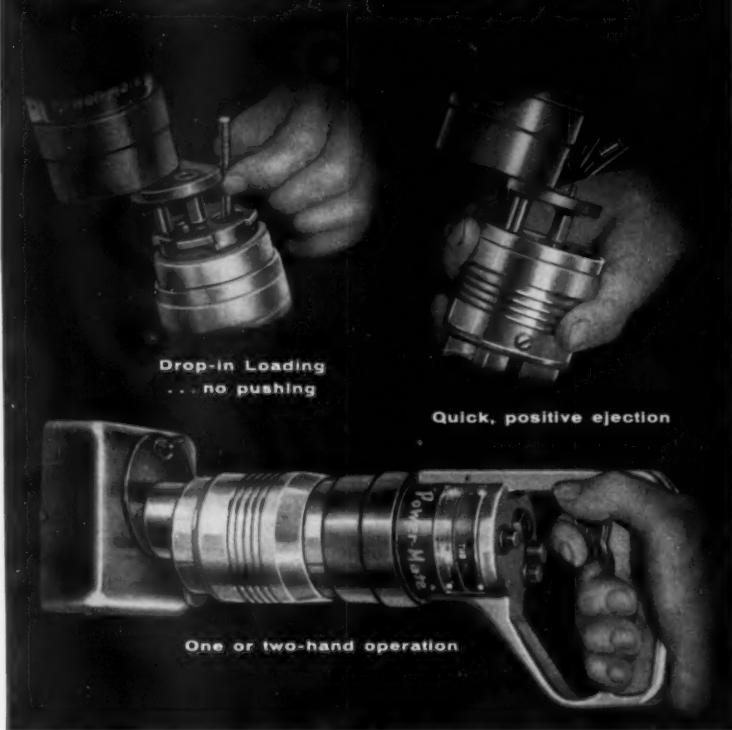
Other featured speakers on the conference program included Charles L. Hamman, Stanford Research official, who cited several problems of western growth related to air pollution, water shortages, transportation and "urban sprawl"; Gerald M. Ives, vice president, Morgan Guarantee Trust of New York, who analyzed problems related to capital requirements; Arthur Barnett, managing director for the National Association of Electric Companies, who discussed legislation affecting the electrical industry, and Dr. Randall M. Whaley, executive director of the National Academy of Sciences, who questioned whether American education was properly geared for the future. Any business which spends less than $\frac{1}{10}$ th of 1% of its budget on research and development is headed for trouble, he said, yet that is what our collective national industrial investment is for educational research.



CANADIAN TRIO at the annual NISA convention recently held in Montreal, Canada, is made up of: (l to r) Hector Roberge, H. Roberge, Inc., Quebec City, Quebec; Gerard Sauve, J. H. Sauve et Fils, Valleyfield, Quebec; and Dave Seaton, Jolliffe-Seaton Electric, London, Ont.

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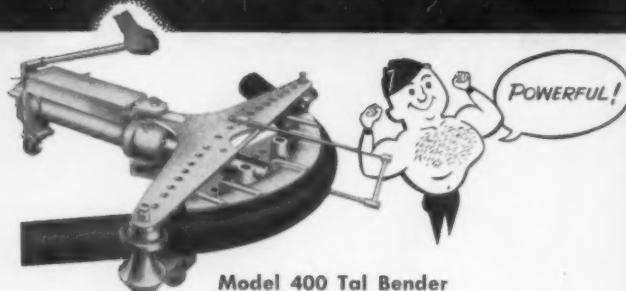
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7.5	33	9.0	40
10.0	40	15.0	44
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100.0	50	150.0	47

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MONTREAL, CANADA, was the scene of the recently held 26th annual and first international convention of the National Industrial Service Association, attended by many Canadian members including: (l to r) C. Birchfield, Canadian General Electric Co., Ltd., Montreal, and Norman Surgeson, Surgeson Electric Ltd., Cornwall, Ont.

Presiding at the convention's opening meeting was Leslie A. Hicks, outgoing president of the PCEA and also president of the Hawaiian Electric Company. Speaking about the economy of our newest State, he said that property values around Honolulu have appreciated more than 20% since the Senate passed the statehood bill last March, and that statehood has introduced an economic boom which is increasing steadily. Emphasizing this activity, he mentioned the construction of numerous commercial buildings, cement plants and other industrial projects, new apartments and extensive home building, of which 80% are being approved for all-electric Medallion citations. This construction will approximate \$225-million on the island of Oahu alone, he said, and electrical construction will account for about 10% of this total.

At the final luncheon meeting, Allen S. King, president of the EEI, summarized the convention theme by advocating teamwork through association activity. Regional and national associations are essential to coordinate and stimulate efforts toward increasing public understanding and acceptance of industry objectives, he said, adding that not enough people understand that our high standard of living is a product of our free enterprise system wherein even our workers are also capitalists in that they own stock in a large percentage of our corporations.

As a final item of business, 12 directors were elected to serve with president Wikle for the year beginning July 1, including W. E. Cranton, Thermador Electric, Los

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Angeles; H. G. Dillin, San Diego G&E; R. L. Engel, Allis-Chalmers, S. F.; H. C. Gerster, General Electric Supply, L. A.; L. M. Guibara, Kaiser Aluminum and Chemical Sales, Oakland; R. G. Holabird, All-Brite Fluorescent Fixtures, Los Angeles; J. K. Horton, Southern California Edison Co.; C. W. Leihy, McGraw-Hill Publishing Co., San Francisco; D. L. Miller, Square D, Los Angeles; Fred Oldendorf, Jr., California Electric Power Co., Riverside; S. W. Scott, Graybar Electric, L. A.; and A. J. Swank, PG&E, S. F. Also on the board will be retiring president Hicks and 12 additional directors with carry-over terms.

Code Changes Discussed By IAEI Chapters

Geographical proximity plus coordinated dates of three western IAEI Chapter meetings made it possible for several industry-recognized leaders to attend successive conventions of electrical inspectors at Winnemucca, Nevada, April 18th; Salt Lake City, Utah, April 20th, and Blackfoot, Nevada, April 22nd.

At all three meetings, changes in the 1959 edition of the NEC were discussed and analyzed by Frank Stetka, field engineer for the National Fire Protection Association.

In addition, Karl Geiges, vice president of Underwriters' Laboratories, Santa Clara, Calif., discussed conductors and insulation at the Nevada meeting, panelboards and service equipment with Utah delegates. Lester Johnson of the General Electric Co., Salt Lake, dis-



THREE INSPECTORS representing City, County and State departments were panel discussion leaders at this year's annual convention of Electrical Maintenance Engineers of California, held in L. A.'s recently completed Furniture Mart March 24-6. Grouped above are Mike Wintz, Ch. Inspector, City of L. A.; Art Veit, Supervising EE, County of L. A., and Ed Muller, State Safety Engineer for Calif.



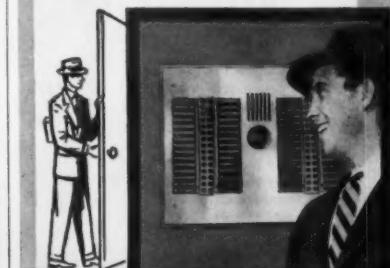
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SWITCHES are available in single and double-pole, 3 and 4-way types; and the new Twin.

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cussed electric heating cable with Idaho inspectors and moderating Code discussion groups at all three meetings. Leon Guibara, Kaiser Aluminum, Oakland, demonstrated aluminum.

Officers from other Sections who attended one or more of these meetings included Chester Hefner, president, and Lou La Fehr, secretary, of the Southwestern Section; James Paxton, president, and W. L. Gaffney, secretary-treasurer, of the Northwestern Section, and Hal S. Morr, past-president both of the IAEI and Northwestern Section.

Each of these speakers reviewed activities of their respective organizations, collectively discussing plans for code workshop sessions, urging inspectors to submit full discussions concerning electrical fires and accidents, inviting those present to attend sectional meetings in Seattle, August 24-6, and in Santa Rosa, August 31-Sept. 3, reviewing contemplated changes in by-laws, and reporting upon recent developments occurring at IAEI headquarters in Chicago.

Prof. I. J. Sandorf of the University of Nevada also attended these meetings to report that a teaching manual was being prepared, planned for inspectors responsible for general building work as well as electrical jurisdiction. The manual, which can be studied with or without the assistance of local school adult education supervision, will cover basic electrical theory and wiring methods, code provisions and reasons for same, plus the relationship and responsi-



CHIEF ELECTRICAL INSPECTOR, William P. Hogan, Jr., explains and defines new provisions of the Chicago Electrical Code during a recent Better Wiring Forum held at the Hotel Sherman.

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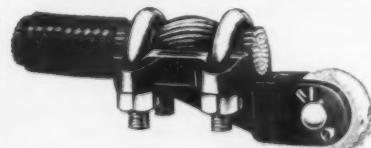


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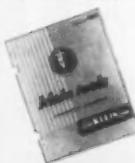
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NEW YORK STATE representation at the recently held annual convention of NISA included: (l to r) Earl Timmerman, Peason and Timmerman, Watertown, N. Y., and Roger Blixt, Westburgh Electric, Jamestown, N. Y.

ibility existing between inspectors, contractors, city officials and the public.

Officers elected by the Nevada Chapter included Ralph Bisset, Reno inspector, as chairman for the coming year; Lynn Steiner, Ely, vice-chairman; John Smales, Elko, secretary-treasurer, also executive committee members E. P. Gibson, R. L. Osborne, Jr., E. C. Braswell, J. Howard Lindsey, M. L. Lundberg, John Kitchen and Norman Revaleati.

Officers who will lead the Utah Chapter next season include chairman William Whetton, Ogden city inspector; 1st vice chairman Lloyd Grames, Board of Fire Underwriters of the Pacific; 2nd vice chairman J. A. Clinger, Orem inspector, and secretary-treasurer A. H. Bywater, Utah Fire Rating Bureau.

New Idaho Chapter officers include L. G. Nelson, State electrical inspector, Buhl, as chairman; A. M. Kopeland of Lewiston, 1st vice-chairman; A. L. Callow of St. Anthony, 2nd vice chairman; Gaynor Dennison of Boise as secretary-treasurer, also Fred Vogt, Delbert Squires and R. C. Young as members of the executive committee.

Honor 33 NISA Members

Thirty-three members of the National Industrial Service Association from 19 states and 3 Canadian provinces were given signal recognition at the 26th Annual NISA convention at Montreal, Canada. Each received a certificate commemorating 50 years of service in the electrical field. Members so honored included:



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At a price that's so nice
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save you time (and that's money) by eliminating the chore of threading rigid conduit on the job. Why waste man hours with threading when these fittings insure positive gripping of the conduit? Save time by specifying only Conduit No Thread Connectors and Couplings. Produced by Conduit Fittings division of U.S. Industries, Inc.



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Harry Condo, Condo Electric Service, Miami, Florida.

Howard R. Dillon, The Alliance Electric Co., Alliance, Ohio.

Charles E. Foster, Paul Electric Supply Co., Fort Dodge, Iowa.

William S. Giles, Giles Armature & Electric Works, Inc., Marion, Ill.

Arthur H. Goodwin, Chace Electrical Co., Inc., Fall River, Mass.

William Wallace Hanks, Southern Electric Service Co., Charlotte, N. C.

Allen J. Headen, Tug River Armature & Machine Co., Williamson, W. Va.

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Jacob Hoffmeister, Hoffmeister Electric, Vancouver, B. C.

Jesse J. Hunt, Roberts-Stage Electric Co., Chicago, Ill.

Wesley Jagger, Wesley Jagger, Inc., Wilmington, Del.

Carol Levison, The Motor Repair & Mfg. Co., Cleveland, Ohio.

Robert E. Medford, Central Electric Co., Fort Worth, Texas.

Victor M. Nussbaum, Nussbaum Electric Co., Fort Wayne, Indiana.

Albert W. Odell, Weaver Electric Co., Denver, Colo.

Martin Panosh, Inland Industrial Electric Service Co., Chicago, Ill.

Lionel Paquin, Harbour Electric Co., Ltd., Montreal, Quebec.

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Francis R. Sterling, Sterling Electric Co., Hartington, Neb.

Peter Surgeson, Surgeson Electric Ltd., Cornwall, Ont.

Wendell Szabados, Wendel Electric Machinery Co., Inc., Brooklyn, N. Y.

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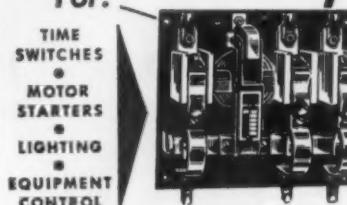
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Whitaker Named U. L. Chief Electrical Engineer

H. B. Whitaker was named chief electrical engineer and vice president of Underwriters' Laboratories, Inc., June 12, upon the recommendation of U. L. President Merwin Brandon and the Board of Trustees. From his headquarters in New York, Mr. Whitaker will head the three electrical departments of the Laboratories and be contact man for such organizations as ASA, AIEE, NEMA, etc.

After being graduated with a BS degree in electrical engineering from North Carolina State College in 1936, Mr. Whitaker joined the staff of Underwriters' Laboratories as an assistant electrical engineer. He entered the U. S. Army Signal Corps in 1941 as a private and was discharged as captain in 1945. He returned to the U. L. staff in 1946; became senior associate electrical engineer in 1950, executive engineer in 1953, and assistant to the vice president in 1957. He is a member of Tau Beta Pi and Eta Kappa Nu, honorary engineering societies; a registered professional engineer in Illinois, and an active member of several AIEE, IAEI and NFPA committees.

R. D. Barton was elected assistant secretary of Underwriters' Laboratories with headquarters in Chicago. He will assist the secretary in technical matters. Mr. Barton was graduated from Mississippi State College in 1940 with a B.S. degree in electrical engineering; joined the U. L. staff as assistant electrical engineer that year; served with the U. S. Army from 1941 to 1946; was made U. L. staff engineer in 1948 and executive engineer in 1953. He is a member of and serves on several IAEI and NFPA committees.



NISA CONVENTION attracted many Canadian members, including: (l to r) Gilles Roy, H. Roberge, Inc., Quebec City, Quebec, and A. W. Patchett, Industrial Electric Co., Everett, Wash.

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Ideal for housing electrical controls, components and terminal strips. Note removable mounting panel. Neoprene gasket on door protects against dust, dirt, oil, water. Strong welded construction. No holes or open seams. Also available in NEMA types 1, 3, 4 and 5.

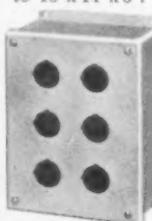


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Heavy gauge
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A complete selection of types and sizes. Fine quality construction and finish. Welded seams. Cover has neoprene gasket. Holes take any standard oil-tight pushbutton. Types range from "Standard" as shown, to Extra Deep, Slim and Pendent. For one to 25 pushbuttons.



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JOHN LAUNDER, Independent Electric Machinery Co., Kansas City, Mo. was among the members in attendance at the annual NISA convention recently held in Montreal, Canada.

Five Contractors on N.I.E.C. C-L Committee

Five electrical contractors are members of the Nebraska-Iowa Electrical Council's (Omaha, Neb.) new committee for the promotion of Certified Lighting. They are: Harry Binder, Evans Electric Corp.; E. J. Grafentin, Sterling Electric Co.; Harold Miller, Miller Electric Co.; Edward Bayer, Bayer Electric Co.; and Harold Kenworthy, Kenworthy Electric.

Omaha Public Power District representatives are committee chairman Walter Scholes, and Robert Gibbs. Representing distributors are Fred Holders, Graybar Electric Co.; and George Tice, Electric Fixture & Supply Company. George Mittauer, Geo. C. Mittauer & Associates; and C. Gordon Christensen, Christensen Lighting Sales are manufacturers agents' representatives. Architect members of the new committee are: E. C. Knudson, Leo A. Daly Co.; and Carl I. Wallin of Henningson, Durham & Richardson.

The new Council committee plans to use the National Lighting Bureau's "Eye-Fi" theme in future promotions.



WAFFLE'S ELECTRIC, Toronto, Canada, was well represented at the 26th annual and first international NISA Convention in Montreal by: (l to r) T. L. Waffle and E. H. Musgrave.

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Model 610 Metal Cutting Band Saw

MOUNTED on WHEELS
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The Kalamobile has rubber-tired wheels and telescoping handles . . . can be shifted from job-to-job by one man with ease. This new Mobile Model M610D cuts pipe and conduit fast and clean. Capacity 6" rounds . . . 10" flats.

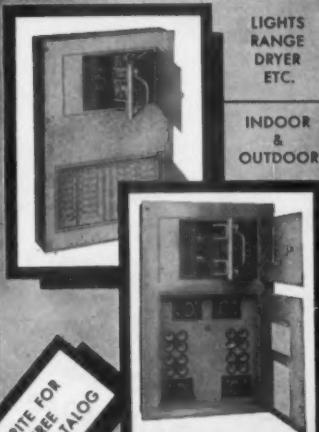
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DATES AHEAD

International Association of Electrical Inspectors—Northwestern Section, Hotel New Washington, Seattle, Wash., Aug. 24-26; Southwestern Section, Flamingo Hotel, Santa Rosa, Calif., Aug. 31-Sept. 2; Eastern Section, Essex and Sussex Hotel, Spring Lake, N. J., Sept. 14-16; Canadian Section, Queen Elizabeth Hotel, Montreal, Quebec, Canada, Sept. 25-26; Western Section, Schroeder Hotel, Milwaukee, Wis., Oct. 5-7; Southern Section, Heidelberg Hotel, Jackson, Miss., Oct. 12-14; Mississippi Chapter, Heidelberg Hotel, Jackson, Miss., Oct. 12-14.

International Association of Electrical Leagues—El Cortez Hotel, San Diego, Calif., Week of August 10.

Western Electronic Show & Convention—Cow Palace, San Francisco, Calif., August 18-21.

Illuminating Engineering Society—National Technical Conference, Fairmont Hotel and Mark Hopkins, San Francisco, Calif., September 7-11.

Third Industrial Nuclear Technology Conference—Co-sponsored by Armour Research Foundation and NUCLEONICS magazine, with the cooperation of the United States Atomic Energy Commission, Morrison Hotel, Chicago, Ill., September 22-24.

Canadian Electrical Manufacturers Assn.—15th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., Canada, September 30-October 2.

Florida Association of Electrical Contractors—Annual convention and 7th Electrical Trade Show, Robert Meyer Hotel, Jacksonville, Fla., October 7-10.

11th Biennial Electrical Industrial Exposition—Sponsored by Essex Electrical League; Armory, Elizabeth, N. J., October 10-12.

National Electronics Conference—Sherman Hotel, Chicago, Ill., October 12-14.

Electrical Progress Show—Sponsored by Electrical Association of Philadelphia, Convention Hall, Philadelphia, Pa., October 13-15.

National Electrical Contractors Association—Annual convention and 5th National Electrical Exposition, Fontainebleau, Eden Roc, Deauville and Carillon Hotels, Miami Beach, Fla., November 9-12.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 9-13.

Industrial Electric Exposition—Sponsored by Electrical League of Western Pennsylvania, Penn-Sheraton Hotel, Pittsburgh, Pa., November 17-19.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 31-February 5, 1960.

16th Annual National Wiring Sales Conference—Warwick Hotel, Philadelphia, Pa., February 25-26.

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You don't baby the Knopp Voltage Testers. They're built to withstand the shocks of rugged daily use.

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It tells quickly if the circuit is open or closed; magnitude of voltage between 110 and 600 a-c or d-c, pure or rectified; 25 to 60 cycles.

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Phase Sequence
Indicator
60 v. to 600 v.
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shows a sequence
A-B-C or C-B-A.
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Among the Manufacturers

Headquarters Announcements

Federal Pacific Electric Co., Newark, N. J., will market under its own trade name all products of its wholly-owned subsidiary, Roller-Smith, Inc., which will continue its manufacturing operations under a new corporate name, Fifty Avenue L, Inc.

Yardney Electric Corp. and Yardney Laboratories, Inc., both of New York, have been consolidated under the name of Yardney Electric Corp.

Multi-Amp Electronic Corp. is new name for Multi-Amp Corp., Union, N. J.

Stromberg Time Corp., Thomaston, Conn.—John V. Barker, sales manager, Time Equipment Sales.

General Electric Co., Schenectady, N. Y.—G. L. Roark, manager of marketing, High Voltage Switchgear Dept., Philadelphia.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—John L. Wiedey, marketing manager, Pittsburgh Works.

Continental-Diamond Fibre Corp., Newark, Del.—Arthur J. Briggs, vice president.

Edwards Co., Norwalk, Conn.—Edwin A. Harris, Jr., products manager.

Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill.—Raymond F. Becker, conduit sales manager, Electrical Conductor Div.

Minnesota Mining & Mfg. Co., St. Paul, Minn.—R. V. Holton, divisional vice president, electrical products division; Burton F. Danielson, electrical insulation sales manager.

Anderson Electric Corp., Birmingham, Ala.—Samuel J. Spurgeon, manager, Utility Engineering Div. and Laboratories.

Garden City Plating and Mfg. Co., Chicago, Ill.—Harold E. Kuehl, secretary.

Dayton Rubber Co., Dayton, Ohio—John Sly, assistant sales manager, Industrial Products Div.

Multi-Amp Electronic Corp., Union, N. J.—Eduardo R. Redhammer, vice president and director of research and development; Rue M. Shoop, vice president and director of publicity; C. Harold Richardson, assistant secretary and chief engineer.

Robertshaw-Fulton Controls Co., Milford, Conn.—Donald J. Neary, production manager, Bridgeport Thermostat Div.

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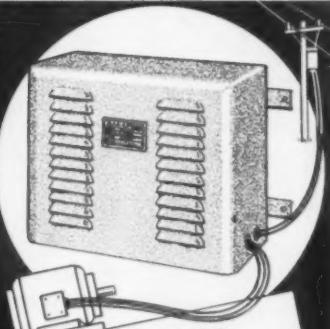
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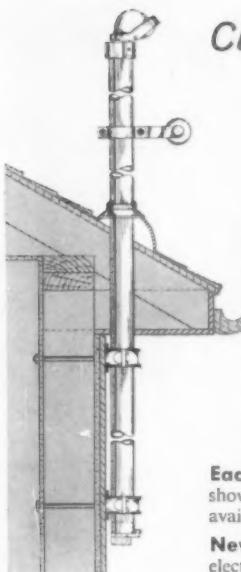
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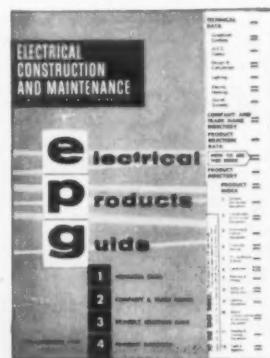
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GET
IT!**



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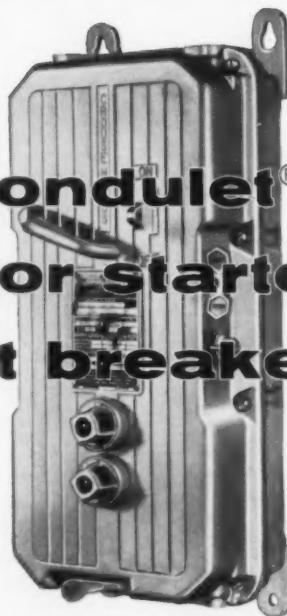
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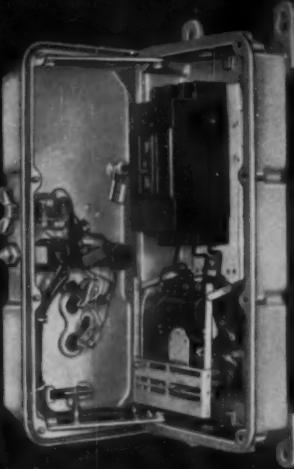
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